Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

aHD1775
.T2U5
RESERVE

CHICKASAW - METROPOLITAN

surface water management survey report

1971

UNITED STATES
DEPARTMENT OF AGRICULTURE
prepared by
SOIL CONSERVATION SERVICE
ECONOMIC RESEARCH SERVICE
U. S. FOREST SERVICE

AD-33 Bookplate
(1-63)

NATIONAL

AGRICULTURAL

LIBRARY

16419

CHICKASAW-METROPOLITAN SURFACE WATER MANAGEMENT SURVEY

TENNESSEE AND MISSISSIPPI

BY

THE UNITED STATES DEPARTMENT OF AGRICULTURE

SPONSORED BY

SHELBY COUNTY SOIL CONSERVATION DISTRICT

MISSISSIPPI BOARD OF WATER COMMISSIONERS

TENNESSEE DEPARTMENT OF CONSERVATION

SHELBY COUNTY CONSERVATION BOARD

JUNE 1971

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

AUG - 21971

CATALOGING - PREP.

4-30376 5-71
USDA-SCS-FORT WORTH, TEX. 1971

326111

aHD1775
.T2U5

RESERVE

"We must develop a more intelligent and wholesome attitude toward the rivers.

We all live on one watershed or another and depend upon that watershed as the life-blood of commerce, health, recreation and general well-being. We must rethink our traditional 'right' to do what we please with our own land and water. All the land in a watershed and all the streams which flow through it carry a responsibility to all the people in the watershed. We must abandon the colonial philosophy that if we ruin one stream we can move on to another. There are no more streams. Increasing population intensifies the urgency."

From "This River Could Die" by John Fetterman in The Courier-Journal & Times Magazine (Louisville, Kentucky).

4-30376

SUMMARY

The United States Department of Agriculture was requested by the Shelby County Conservation Board to make a comprehensive study for the development of the water and related land resources in the drainage areas of the Wolf and Loosahatchie Rivers, Nonconnah and Horn Lake Creeks. This land area of 1,221,900 acres includes all of Shelby County and portions of Tipton, Fayette, Haywood and Hardeman Counties in Tennessee and parts of DeSoto, Marshall and Benton Counties in Mississippi.

The application for such a study was submitted through the Commissioner of the Tennessee Department of Conservation. The Shelby County Soil Conservation District and the Mississippi Board of Water Commissioners joined the Tennessee Department of Conservation and the Shelby County Conservation Board as sponsors of the survey.

The study was conducted in close cooperation with the Shelby County Conservation Board, the Shelby County Soil Conservation District, and the Chickasaw Advisory Committee composed of representatives of local government and conservation groups in the study area. The Department of Agriculture carried out the survey under the general guidance of a USDA Field Advisory Committee composed of representatives of the Soil Conservation Service, Forest Service, and Economic Research Service. The Soil Conservation Service provided overall leadership in carrying out the responsibilities of the survey.

The primary objectives of the study were to identify the problems of water and related land resources, determine the needs and potential for development, and prepare a plan for development which would promote economic growth and development.

Erosion and sedimentation are identified as major problems of the basin. The hilly coastal plain soils in the headwaters of the Wolf and Loosahatchie are especially subject to gully erosion. The continuous cultivation of row crops has contributed to an excessive loss of top soil and the creation of critically-eroding areas. The mid-section of the basin is used mostly for general farming operations and the dominant erosion problem is sheet erosion. The western portion of the basin containing the urban areas of Memphis, Millington, Bartlett, Germantown, Collierville, and Southhaven, is affected by erosion and sediment problems occurring as a result of excavation for new development. Rates of soil losses may exceed 200 tons per acre annually when these areas are not controlled.

Flooding is widespread and damaging throughout the basin. Most of the tributary streams and portions of the four main stems flood quite frequently. Damages from flooding on the Wolf and Loosahatchie Rivers are mainly agricultural. On Nonconnah Creek the damage is mainly to urban developments. About 128,000 flood plain acres suffer estimated average annual damages of nearly 2 million dollars in the Chickasaw Basin.

4-30376

Uncontrolled development along the flood plains of the major tributaries increases potential damages from flooding as buildings, highway fills, and sanitary fills are placed in the flood plains. The elevation of floodwater can be expected to rise to compensate for the loss of flow area. This unguided development of flood plains is a major problem in Shelby County.

Developments of the water and related land resources are needed to (1) improve standards of living, economic opportunities, and personal well-being of people in the basin, (2) provide land treatment for protection and maintenance of the land resource and for control of critical sediment-producing areas, (3) provide flood control and flood plain management along the streams, (4) improve recreational opportunities, fish and wildlife habitat, quality of water, and timber production, (5) improve the quality of the environment, and (6) improve economic efficiency by the developments in flood protection and land treatment that lower production costs.

The proposed plan provides for the conservation, development, and use of water and related land resources of the Chickasaw-Metropolitan Basin in the best interests of the people now and in future years. Basic elements of the plan consist of (1) land use and conservation treatment of rural and urban land to be carried out by landowners - some measures would be eligible for federal cost-sharing, (2) development of watershed projects to prevent floods, provide water storage for recreation, fish and wildlife, and other purposes, (3) management of flood plain land use to control and reduce flood losses, (4) development of outdoor recreation facilities to meet demands of the growing population, and (5) improvement of the environment quality of the basin.

The comprehensive plan requires treatment of all land in the basin not already adequately treated. This includes 366,100 acres of cropland, 165,200 acres of grassland, 260,000 acres of forest land, and 22,400 acres of miscellaneous land. Critical area treatment would be completed on 183,400 acres which includes approximately 124,600 acres of severe sheet erosion. Structural works of improvement consist of approximately 78 flood-retarding dams and 280 miles of channel improvement. Three of the dam sites have been identified as suitable for recreation development. These reservoir areas would provide 2,800 surface acres for water-based outdoor recreation.

Two alternative early action programs are proposed. The Alternative I program would relieve the most pressing natural resource problems and satisfy the most urgent needs for resource development. It would be carried out over a 15-year period and would require additional federal authority and appropriations in excess of going program costs. The installation of this program would reduce the present average annual floodwater damage from $1,969,450 to $962,150. The program includes the development of seven watersheds with 60 floodwater-retarding structures that would store approximately 126,000 acre feet of floodwater.

4-30376

Conservation treatment of 337,000 acres of land would reduce erosion about 50 percent. Runoff from low-intensity rainfalls would be reduced by approximately 25 percent.

Total federal cost of the Alternative I program would be 46.5 million dollars. Cost to local sponsors would be 16.4 million dollars. Contributions by private individuals for land treatment and environmental improvements would amount to 21.1 million dollars. Average annual benefits credited to watershed project structural measures would be 2.8 million dollars against annual costs of 1.9 million, a benefit to cost ratio of 1.5:1. Benefits attributed to land treatment were assumed to be at least equal to cost but it is believed that such benefits to the economy, protection of resources, and to the environment are much greater.

The Alternative II program is a scaled-down version of Alternative I. It would provide for about one-half as much land treatment as for Alternative I. Four watershed projects would be developed instead of seven for Alternative I. It would be carried out over a 15-year period. Additional federal authority and funds would be required. The installation of Alternative I would not go as far toward solving problems and meeting needs as Alternative I, but is designed to provide maximum beneficial effects in the areas of most critical needs.

Federal cost of the Alternative II program would be 32.9 million dollars with a cost to local sponsors of 15.1 million dollars. Contributions by private individuals would amount to 10.2 million. Benefits from structural measures in watershed projects would be 2.5 million dollars against costs of 1.7 million, a benefit to cost ratio of 1.4:1.

CHICKASAW-METROPOLITAN SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI

TABLE OF CONTENTS

4-30376

LIST OF TABLES

4-30376

LIST OF FIGURES PAGE

4-30376

PHOTOGRAPHIC CREDITS

Upper photo, page 1-3, Newman·Fury photo, courtesy Memphis Chamber of Commerce; lower photo, page 4-21, Memphis Press-Scimitar; lower photo, page 7-19, State of Tennessee Photographic Service; page 7-30, Tennessee Game and Fish Commission; page 9-6, U. S. Forest Service; all other photos by Soil Conservation Service.

4-30376

I. INTRODUCTION

This report by the United States Department of Agriculture presents the findings of a comprehensive study of the water and related land resources in the Chickasaw-Metropolitan Surface Water Management Survey area. The area comprises the drainage areas of the Wolf and Loosahatchie Rivers, Nonconnah and Horn Lake Creeks.

Sponsors of the survey were the Shelby County Conservation Board which contributed $75,000 as a part of the cost; the Shelby County Soil Conservation District; the Tennessee Department of Conservation, and the Mississippi Board of Water Commissioners. The investigations were coordinated with these sponsoring groups and with other local, state and federal agencies.

The need for the study arose from a realization by responsible public officials and planners that the intelligent management and development of water and related land resources is essential to an orderly growth and economic development in the basin. The rapidly-urbanizing Shelby County area with a population of 718,000 has reached a point in its expansion that requires making more efficient use of the flood plain lands along the major streams. In the upstream rural areas, water and land resources are inadequately developed and are not utilized to their maximum potential. These areas have lagged behind other parts of the nation in economic growth.

The survey clarifies the problems and needs for development of water and related land resources of the basin and defines a plan of development which will be workable and acceptable from the physical, financial, and esthetic points of view. Installation of the plan elements will improve the natural environment, provide for sound growth and expansion of the area, and improve the economic potential.

Department of Agriculture agencies involved in the survey were the Soil Conservation Service with responsibility for overall leadership, the Forest Service, and the Economic Research Service. The Tennessee Department of Conservation, the Tennessee Game and Fish Commission, and the Mississippi Game and Fish Commission participated through consultation and by providing information from other studies. The Bureau of Outdoor Recreation of the U. S. Department of Interior furnished an interim report on recreation demand, supply, and needs. The Bureau of Sport Fisheries and Wildlife participated with an ad hoc biology work group in furnishing information about fish and wildlife resources of the basin. The United States Army Corps of Engineers, through the Memphis District Office, supplied useful data and information throughout the course of the study. The Memphis and Shelby County Planning Commission, the Memphis City Engineer, and the Shelby County Engineer all provided valuable data used in the study.

4-30376

Historical Background of the Study

In 1964, the Shelby County Conservation Board requested the Soil Conservation Service to review the land and water resource problems in the merging rural and urban areas of Shelby County and determine what assistance it could render. The Board sought a study to identify floodwater problems and to propose criteria and plans for development of interrelated soil and water management potentials. In early 1965, the Soil Conservation Service advised the Conservation Board that a river basin type survey could be made under authority of Section 6 of the Watershed Protection and Flood Prevention Act. Such a study would require approval of the Secretary of Agriculture. The Conservation Board proceeded to file application for a study. The application was submitted through the Commissioner of the Tennessee Department of Conservation. Congress approved funding for the survey in the Agricultural Appropriation Act for fiscal year 1967. On September 19, 1966, the Soil Conservation Service informed the Conservation Board of its readiness to proceed with the survey.

Objectives

The primary objectives of the study were to identify the problems of water and related land resources, determine the needs and potential for development, and prepare alternative development plans. The plan would facilitate orderly development of natural resources by providing for (1) sound development and use of flood plains depending upon the degree of flood control and water management attainable; (2) the development of potential recreation facilities to meet present and emerging demands; (3) the protection of water resources from sediment and agricultural pollution; (4) protection and maintenance of the soil resource base and (5) improvement of the environmental quality in respect to water, recreation, esthetic, and fish and wildlife values.

A further objective was to strengthen community development by facilitating a combination of agricultural production and recreation development that would provide more jobs and higher personal incomes. It was the aim to promote economic growth and development consistent with overall national objectives. Components of the program would be aimed towards contributing to the satisfaction of current and long-term needs and providing for efficient utilization of resources. It would be the intent of the plan to outline a program within which water and related land resources could be developed in proper relationship to each other.

The Study Area

The Chickasaw-Metropolitan Surface Water Management Survey area is located in southwestern Tennessee and northwestern Mississippi. It includes the drainage areas of the Wolf and Loosahatchie Rivers, Nonconnah and Horn Lake Creeks, a total land area of 1,221,900 acres. All of Shelby County and portions of Tipton, Fayette, Haywood, and Hardeman Counties are in the Tennessee part of the basin. The Mississippi area of 214,000 acres

Memphis, on the bluffs of the Mississippi River, is the population and trade center of the Chickasaw-Metropolitan Basin. Although blessed with bountiful supplies of surface and underground water, parts of the city are plagued with flooding and pollution of surface waters.

Agriculture is the mainstay of the economy in the upstream lands of the basin. Some of these lands are severely eroded, causing a loss in agricultural production and contributing to downstream problems.

4-30376

includes portions of DeSoto, Marshall, Benton, and Tippah Counties. The basin extends north, east, and southeast from Memphis. It is about 65 miles long and 35 miles wide.

Two dominating features of the basin are immediately apparent. First, its four streams all rise in rural areas and in their lower reaches pass through Memphis and the urbanizing parts of Shelby County. Second, the fine silty soils in the watersheds are some of the most erodible in the United States, producing large quantities of sediment that pollutes the streams directly and indirectly and acts as a carrier for other stream pollutants.

Authorization

The Department of Agriculture conducted the survey under the authority of Section 6 of the Watershed Protection and Flood Prevention Act of the 83rd Congress, Public Law 566 as amended. The Act authorizes the Secretary of Agriculture to cooperate with other federal, state, and local agencies in their investigations of watersheds, rivers, and other waterways to develop coordinated programs. The Department of Agriculture Appropriation Bill for 1967 carried funds to begin the Chickasaw-Metropolitan Survey.

Description of Survey Procedure

The U. S. Department of Agriculture carried out the survey under the general guidance of a USDA Field Advisory Committee, composed of a representative from the Soil Conservation Service, the Economic Research Service, and the Forest Service. The Soil Conservation Service provided overall leadership in carrying out USDA responsibilities in the survey. A river basin staff was established at Memphis in the fall of 1966.

The personnel assigned to the Chickasaw-Metropolitan Surface Water Management Survey by the three agencies functioned as a team under guidance of the Field Advisory Committee. Each agency had responsibility for certain aspects of the survey as outlined in a plan of work approved by the committee. The Chickasaw Advisory Committee with local basinwide representation of soil conservation districts, watershed districts, county government, planning commissions, and other groups and individuals actively participated in the survey. This committee made invaluable contributions by expressing local desires and objectives and furnishing "grass-roots" counsel and guidance to the survey staff.

Major elements of the U. S. Department of Agriculture survey consisted of:

- An appraisal of all water and related land resources, including data on soils, rainfall and streamflow, land use, fish and wildlife, and recreation.

- Studies and projections of economic development including volume and value of agricultural and timber production,

income and employment in basic agricultural and forestry activities, use of rural lands for major crop groups, forest production, fish and wildlife, and recreation, and income and other measures of economic activity directly related to basic agricultural and forest industries.

- Projections of goods and services for the years 1980, 2000, and 2020 were made within a national framework. The above information was used in determining problems, needs, and potentials for resource development for the years 1980, 2000, and 2020. The determination of resource development needs involved the translation of projections into needs for water and related land resource uses.

- Investigation of upstream watersheds to determine their potential for project development under Public Law 566 authority. Feasible watershed projects were identified and evaluated as to their effect on economic growth and development. This involved consideration of flood protection, improvement of water quality, stream channel rehabilitation, and fish and wildlife enhancement. Water supply needs for recreation, irrigation, municipal, and industrial use were considered.

- A survey of the area not included in potentially feasible upstream watersheds to identify similar developments needed.

- Identification of governmental and private institutions and organizations having capability for solving problems and contributing to the development of the water and related land resources. Appraisal was made of the opportunities and limitations for resource development under current laws and existing programs.

- Consideration of alternative methods of achieving the objectives.

Suggested Uses and Values of the Report

The information presented in this report can be used by county and city governments, soil conservation districts, watershed districts, planning commissions, and other local groups in planning land use, developing budgets, and setting priorities for expenditure of funds. It will be helpful in planning for early acquisition of needed reservoir areas, recreational developments, and other improvements. Those with responsibility for planning transportation, public utility systems, and recreational developments can avoid conflicts by considering the locational developments of water and related land resources recommended in the comprehensive basin plan.

4-30376

The report can be helpful in long-range planning by state governments for parks, fish and wildlife developments, water resources, forestry programs, scenic river development, and other natural resource developments. The report provides recommendations and information useful to both state and federal agencies and officials in setting priorities for resource development. The U. S. Department of Agriculture can use the report as the basis for planning, programming, and budgeting its efforts in cooperation with soil conservation districts, watershed groups, and other resource development groups.

Information about soils, soil use suitability, flood problems, and water and related land resources can assist land developers and industrial interests to select suitable development sites.

4-30376

II. NATURAL RESOURCES OF THE BASIN

This chapter describes the natural resources of the Chickasaw Basin. A knowledge of the nature, characteristics, and amount of these resources is important to an understanding of tne major resource problems and the formulation of alternatives for water and related land resource development. The quality and conditions of the water, land, plants, fish, and wildlife determine, in large measure, the quality of environment in which the people live. The environment can be improved by making intelligent adjustments in the conditions and use of these resources.

Climate

The average annual rainfall over the basin is about 50 inches. October is the driest month with an average of less than 3 inches, and January is the wettest month averaging more than 6 inches. About 58 percent of the annual rainfall occurs during the months of April through November. Generally, the winter rains are of several days duration and cover large areas, but ordinarily the intensity is not severe. Storms of this nature have caused the maximum floods on Wolf River and the Loosahatchie River. Summer rains are usually of the thunderstorm type with high intensities and cover much smaller areas. Storms of this nature often cause flash flooding on many of the smaller streams in the Chickasaw Basin. The average annual snowfall over the basin is approximately four inches. Snow seldom stays on the ground for more than a day or two at any one time.

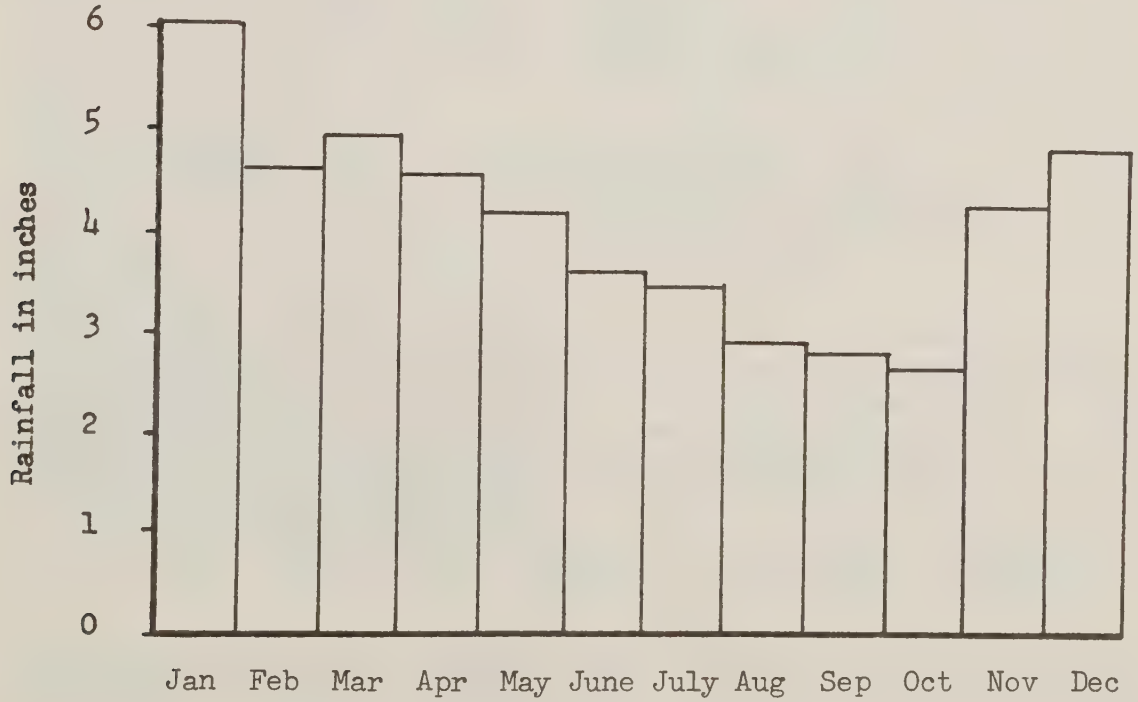


Figure 2.1 - Average monthly rainfall at Memphis, Tennessee
Chickasaw-Metropolitan Surface Water Management Survey

4-30376

Mean annual temperature over the basin is about 62 degrees Fahrenheit. January is the coldest month with an average of about 41°. July is the hottest month with an average of 81°. Maximum temperatures of 105° to 107° have occurred during the months of June through September, and minimums of minus 11° to minus 14° during the months of January and February. A temperature of 90° or above can be expected to occur on the average of about 69 days each year. A temperature of 32° or below can be expected to occur on the average of about 60 days during the year. Temperatures below zero rarely exceed one or two days a year. The average annual lake evaporation is approximately 41 inches with about 73 percent of this occurring from May to October. The average length of the growing season is about 237 days. The first and last killing frosts generally occur in the months of October and April, respectively.

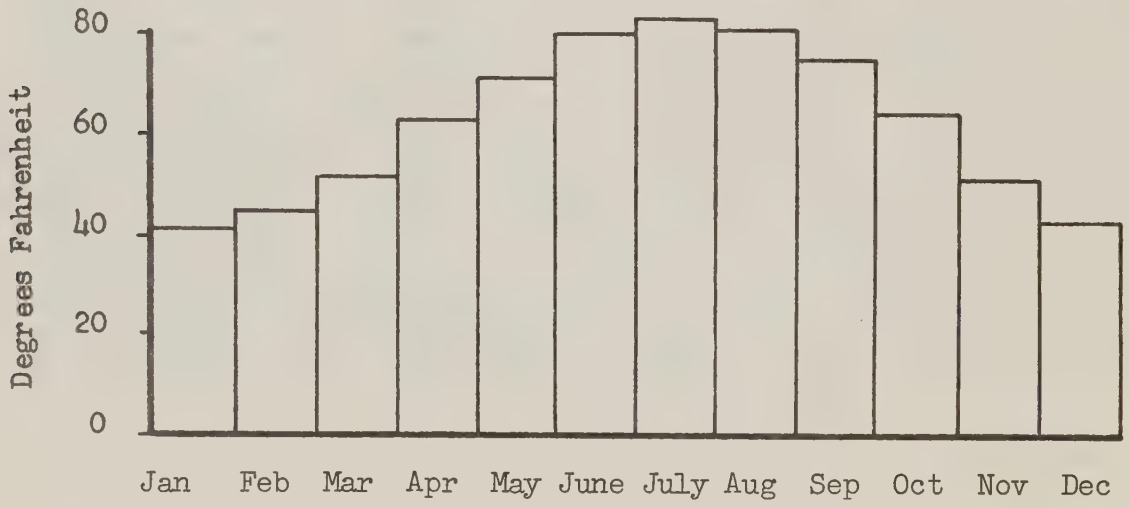


Figure 2.2 - Average monthly temperature at Memphis, Tennessee
Chickasaw-Metropolitan Surface Water Management Survey

Physiography and Geology

The Chickasaw Basin lies primarily in one geologic-physiographic province - the West Tennessee Plain. Only a small portion of the eastern end of the basin lies in the West Tennessee Uplands province. The uplands are dissected and hilly with some belts of rolling topography. Localized swamp conditions are present along many of the streams. The West Tennessee Plain slopes gently westward from an elevation of 700 feet to 400 feet. Topography is gently rolling, interrupted by small ridges and drainage divides. Some gullied topography has developed. Swampy conditions are common.

These physiographic provinces make up a portion of the eastern half of a larger geologic unit known as the Mississippi Embayment of the Gulf Coastal Plain.

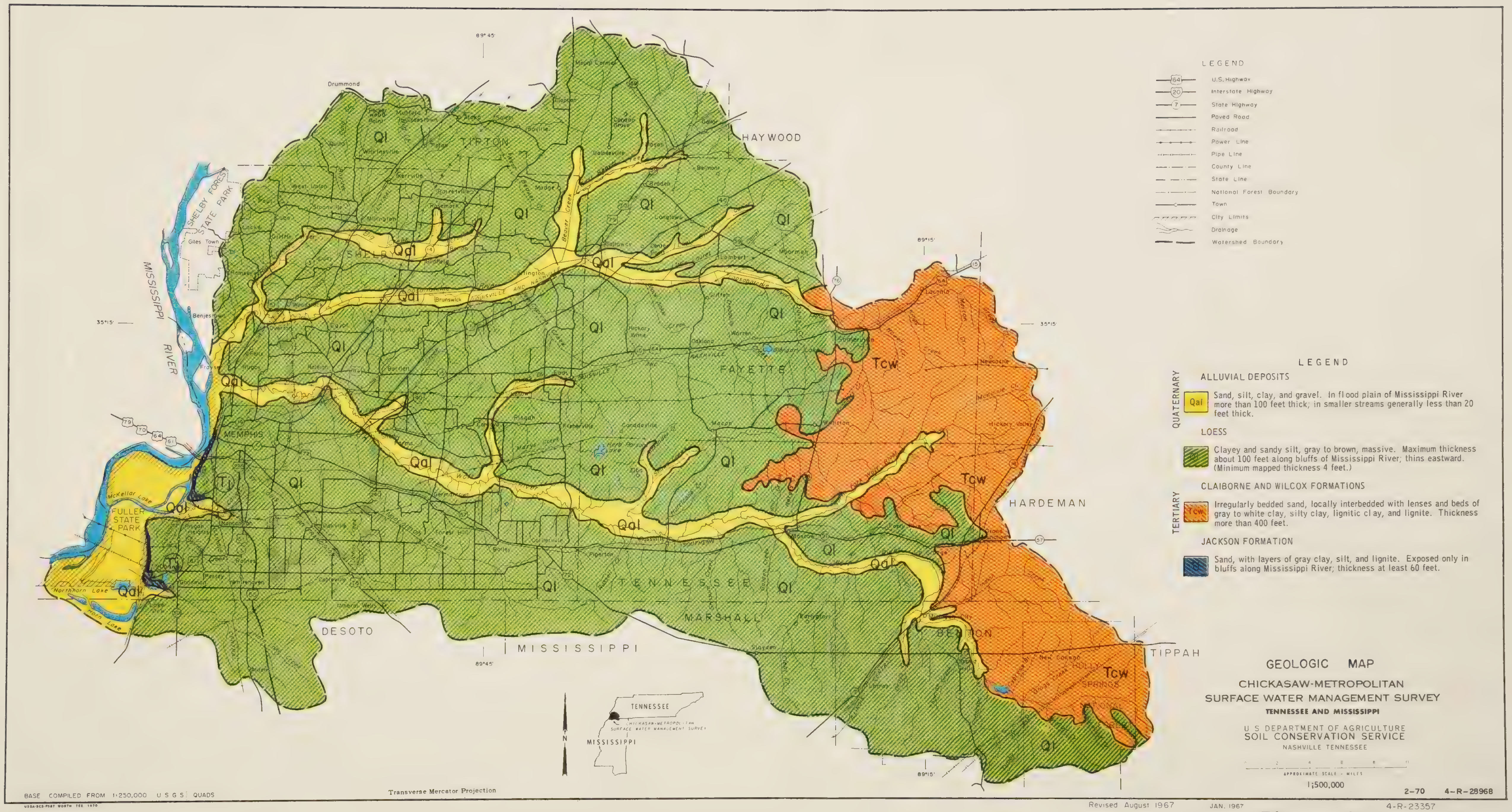

LEGEND
U.S. Highway
Interstate Highway
State Highway
Paved Road
Railroad
Power Line
Pipe Line
County Line
State Line
National Forest Boundary
Town
City Limits
Drainage
Watershed Boundary
LEGEND
QUATERNARY
ALLUVIAL DEPOSITS
Qal
Sand, silt, clay, and gravel. In flood plain of Mississippi River more than 100 feet thick; in smaller streams generally less than 20 feet thick.
LOESS
Clayey and sandy silt, gray to brown, massive. Maximum thickness about 100 feet along bluffs of Mississippi River; thins eastward. (Minimum mapped thickness 4 feet.)
TERTIARY
CLAIBORNE AND WILCOX FORMATIONS
Tcw
Irregularly bedded sand, locally interbedded with lenses and beds of gray to white clay, silty clay, lignitic clay, and lignite. Thickness more than 400 feet.
JACKSON FORMATION
Sand, with layers of gray clay, silt, and lignite. Exposed only in bluffs along Mississippi River; thickness at least 60 feet.
MISSISSIPPI RIVER
SHELBY FOREST STATE PARK
FULLER STATE PARK
MEMPHIS
TIPTON
HAYWOOD
FAYETTE
HARDEMAN
TENNESSEE
MISSISSIPPI
DESOTO
MARSHALL
BENTON
TIPPAH
Ql
Qal
Tcw
Tj
89°45'
89°15'
35°15'
TENNESSEE
CHICKASAW-METROPOLITAN SURFACE WATER MANAGEMENT SURVEY
MISSISSIPPI
N
GEOLOGIC MAP
CHICKASAW-METROPOLITAN
SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NASHVILLE TENNESSEE
APPROXIMATE SCALE - MILES
1;500,000
2-70 4-R-28968
BASE COMPILED FROM 1:250,000 U S G S QUADS
Transverse Mercator Projection
Revised August 1967
JAN. 1967
4-R-23357

Figure 2.3

For millions of years, an arm of the Gulf Sea occupied the embayment and several thousand feet of sediment was deposited. Geologic material from Tertiary to Quarternary were deposited in the basin. Subsequent erosion has exposed these materials. These formations consist primarily of clay, sand, and silt with terrace deposits of gravel. Pleistocene wind-blown silt covers most of the basin. The deposits of sand and gravel now form vast water-bearing aquifers which produce large quantities of water.

The Mississippi Embayment forms a trough which plunges to the south following the course of the Mississippi River. This trough is filled with the old Gulf Sea sediments. In the basin these formations are oriented northeast-southwest and dip to the west-southwest. No prominent structural features are found within the basin.

The drainage pattern of the basin is made up of four major tributaries of the Mississippi River which are fed by many smaller streams branching out alternately. The flood plains are flat and vary from a few hundred feet wide in the upper reaches to about one and one-half miles wide in the lower reaches. Geologic features of the basin are shown in Figure 2.3.

Land Resources

LAND RESOURCE AREAS

The Chickasaw Basin is composed of three land resource areas. They are the Southern Mississippi Valley Alluvium, the Southern Mississippi Valley Silty Uplands, and the Southern Coastal Plain. The Southern Mississippi Valley Silty Uplands comprise 94 percent, or 1,148,600 acres, of the basin. The Southern Coastal Plain covers about 5 percent, or 67,757 acres. Only about 5,543 acres of the basin lies in the Southern Mississippi Valley Alluvium.

Southern Mississippi Valley Silty Uplands - Approximately 82 percent, or 938,700 acres, of the Southern Mississippi Valley Silty Uplands land resource area is classified as agricultural lands according to the Conservation Needs Inventory of 1966.[1/] Sixty-six percent of this area is upland. About fifty percent of this land resource area (LRA) is used for cropland. This is largely a cash crop area, with cotton, corn, and soybeans being the major crops produced. Some of the best soils for crop production in the nation are found in this LRA. Forestry and livestock also play an important role in the land use and economy of the area, with 27 percent in forest land, 18 percent in pasture, and 5 percent other. The city of Memphis, Tennessee occupies 217 square miles, or 138,800 acres.

Of the 319,600 acres of bottom land, it is estimated that 158,600 acres are in crops, 34,200 acres pasture, 115,900 acres forest, and 10,900

1/ All references to Conservation Needs Inventory in this report refer to expanded field data rather than the adjusted data adopted by county, state, and national CNI committees.

4-30376

acres other. Forty-seven percent, or 290,900 acres, of the 619,100 acres of upland is used for cropland; 23 percent, or 142,400, for pasture; 26 percent, or 161,000, for forest; and 4 percent, or 24,800, for other.

The sharply-dissected plains have a thick loess mantle which is underlain by unconsolidated sands, silts, and clays mainly of marine origin.

Southern Coastal Plain Area - The Southern Coastal Plain land resource area of the basin is located in the upper reaches of the Wolf River in Mississippi. Nearly all the area is in farms, with most of the remainder in national forest. The area contains 61,100 acres of agricultural land, according to the Conservation Needs Inventory. Seventy-four percent or 45,200 acres of this area is uplands. Thirty-four percent of the upland is being used for cropland, 20 percent for pasture, 43 percent for forest and 3 percent other. It is estimated that 5,100 acres, or 32 percent of the 16,000 acres of bottom land is in forest cover. Other bottom land uses are 4,000 acres, or 25 percent, cropland; 6,400 acres, or 40 percent, pasture; and 500 acres, or 3 percent, other uses.

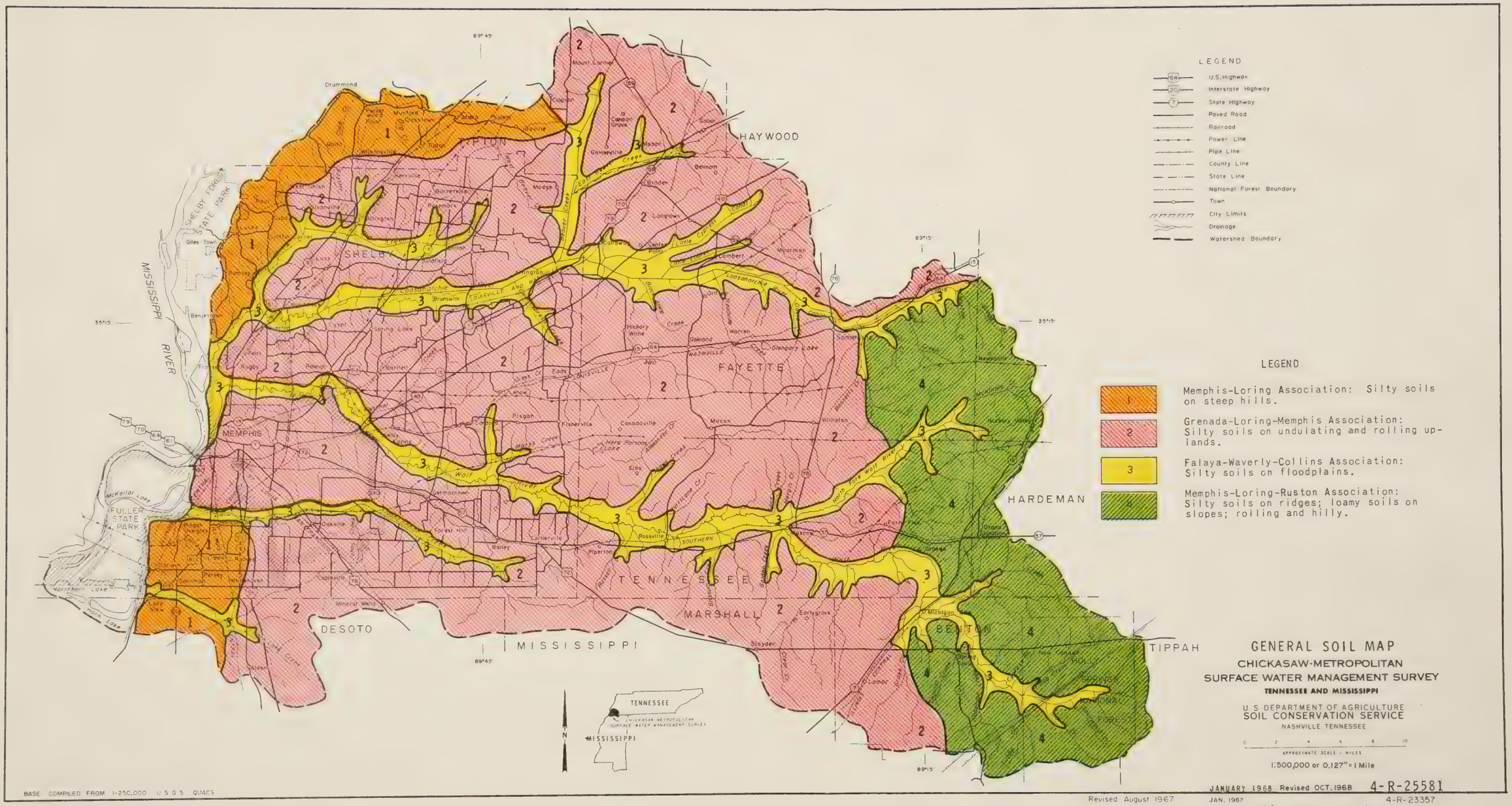
The gently to strongly-sloping dissected coastal plain is underlain by unconsolidated sands, silts and clays. In their upper reaches stream valleys are narrow, but the lower parts of the valleys are broad and have widely-meandering stream channels.

Southern Mississippi Valley Alluvium - This area is a relatively-small part of the Chickasaw-Metropolitan Surface Water Study area, comprising less than 5,600 acres. The area consists of flood plains and terraces of the Mississippi River and is influenced primarily by the Mississippi River. Nearly all the area is in farms. About 20 percent, or 1,100 acres, is forest land; 40 percent, or 2,250 acres, is cropland; and 40 percent, or 2,250 acres, is pastureland.

SOIL ASSOCIATIONS

Each soil association is a broad landscape that has a repeating pattern of soils and is named according to the two or more most extensive soil series. Each area also includes other soils which are less extensive and may or may not be like the dominant soils. The general soil map, Figure 2.4, indicates the distribution of soil associations in the basin. Because of the small scale of the map and the use for which it was intended, the general soil map does not provide information about individual farms or small tracts of land and is not designed for detailed or operational planning. Information on smaller areas or tracts can be obtained from soil survey maps at Soil Conservation Service offices.

1. Memphis-Loring Association - This association is in the extreme western part of the basin and is an area of hills and ridges. The ridge-tops are narrow and winding. Long, crooked drains form deep, narrow hollows. The nearly-level floors in the hollows are seldom more than 200 feet wide. The steep hillsides are most conspicuous, having a slope range of 15 to 65 percent. The soils are formed in deep silt deposits, and are predominantly well-drained and naturally fertile.



GENERAL SOIL MAP
CHICKASAW-METROPOLITAN SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NASHVILLE TENNESSEE

APPROXIMATE SCALE - MILES
0 2 4 6 8 10

1:500,000 or 0.127" = 1 Mile

JANUARY 1968 Revised OCT. 1968 4-R-25581
Revised August 1967 JAN. 1967 4-R-23357

Figure 2.4

The Memphis and Loring soils have brown silty surface layers and dark brown silty subsoil. Loring has a mottled brown and gray compact layer fragipan at a depth of about 28 inches. Adler and Convent soils occur on narrow strips in the hollows. These soils are silty to a depth of several feet and have a brown surface layer. The Adler soils are mottled gray and brown below a depth of about 18 inches, and the Convent soils are uniformly gray below this depth.

About 80 percent of this association is forested and most of this is on the steeper slopes. The soils on the more gentle slopes are suited to a wide variety of crops. Because of the steep slopes and silty nature of the soils, the association has serious limitations for agriculture and some limitations for residential and industrial development.

2. Grenada-Loring-Memphis Association - This association is predominantly undulating to rolling. It consists of broad ridges that are gently sloping with strongly sloping side slopes, and many small drainageways. The soils of this association formed in silt deposits ranging from 5 to more than 20 feet thick. Most of the area is well drained or moderately well drained. Grenada soils, which are moderately well drained, predominate. They have a brown silty surface layer and a yellowish-brown silt loam subsoil. A fragipan begins 16 to 28 inches below the surface, which causes water to drain slowly through the subsoil and influences the use suitability and management requirements for crops. The Grenada soils are commonly on nearly level wide ridgetops and sloping hillsides. The moderately well drained Loring soils have a brown, silty surface layer and a dark brown, silt loam subsoil with a fragipan starting at about 28 inches below the surface. The Loring soils are on the sloping ridgetops and hillsides. Memphis soils, which are well drained, have a brown, silty surface layer. The subsoil is dark brown, silty clay loam. Memphis soils are on the broader ridgetops and steeper hillsides. Collins and Falaya soils are in the adjacent narrow bottoms.

Some damage from erosion is evident, especially on the more sloping parts that have been used intensively for crop production. Crops respond well to applications of lime and fertilizer on the soils in this association. Approximately 80 percent of this association has been cleared and used primarily for field crops such as cotton, soybeans, corn, hay crops, and small grain. Only a small part is in pasture or forest.

3. Falaya-Waverly-Collins Association - These soils occupy the alluvial plain of the Loosahatchie and Wolf Rivers and Nonconnah Creek. All of these soils are susceptible to flooding. This commonly occurs in winter and spring. The soils are silty and fertile, but differ in natural drainage. The Collins soils, which occupy about 15 percent of the association, are best drained of the three, although not well drained. Ranking next are the Falaya soils, which occupy about 65 percent of this association. The Waverly soils, which occupy about 20 percent of the association, are the wettest, although not too wet for growing corn and soybeans if moderate artificial drainage is provided.

About 75 percent of this association is forest land, and is productive of many species of trees. Mainly because of their susceptibility to flooding, but also because of their silty texture and deficiencies in natural drainage, they have serious limitations for housing developments and road construction.

4. Memphis-Loring-Ruston Association - This association is moderately dissected with narrow gently sloping ridgetops, steep side slopes, and narrow bottoms along the many drainageways. The Memphis and Loring soils are on the ridges, where they developed in silty material that ranges from 3 to 6 feet thick over unconsolidated sands and sandy clays. They have brown silty surface layers and dark brown silty subsoils. The Ruston soils occur on the steep hillsides. They have a brown loamy surface layer and yellowish-red sandy clay loam subsoil. The bottom soils along the drainageways are silty with some small sandy spots included. They range from well to poorly drained. Gullied areas are common in this association, especially on the steeper slopes. The gently sloping ridges and narrow bottoms are suited for crops such as cotton, soybeans, corn, and pasture. Many small severely eroded areas that have been cultivated are idle or reverting to woodland. Most of the steeper slopes are in woods.

LAND USE INTERPRETATIONS

The general soil map contains four soil associations. The map and the interpretations are useful for providing information about the soil resources of communities, parts of counties, whole counties, or the river basin. This information can be used for planning land use of large areas and can assist with the planning and development of major parts or all of the river basin.

Interpretations utilize information prepared by the Soil Conservation Service for all major land resource areas. Table 2.1 gives degrees of limitations for five land uses. The terms slight, moderate, and severe appraise each association according to the characteristics of the dominant soils and their major limitations. They are defined as follows:

Soil Limitation	Definition
Slight	Soils have few or no properties that make them unfavorable for a particular use; there are no problems or there are minor problems that can be easily overcome.
Moderate	Soils have one or more properties that make them unfavorable for a particular use; there are problems present that can normally be overcome with correct planning, careful design, and good management.

Table 2.1 - Degree of limitation for selected land use and the chief limiting properties 1/
Chickasaw-Metropolitan Surface Water Management Survey

Soil assoc. no.	Dominant soil series	Est. % of assoc.		Residential w/Central sewer sys.	Residential w/Septic tank sewage	Commercial Light industry	Commercial Heavy industry	Recreation Developed	Agriculture	Forestry
1	Memphis	80	Degree of limitation	Moderate to severe	Moderate to severe	Severe	Severe	Moderate to severe	Severe	Slight
	Loring	5	Limiting properties	Sl.	Sl. Perc.	Sl.	Sl.	Sl. Traf.	Sl. Er.	-
	Other	15								
2	Grenada	35	Degree of limitation	Slight to moderate	Severe	Moderate	Moderate	Moderate	Slight to moderate	Slight
	Loring	25	Limiting properties	Sl. Prod.	Perc.Fl.Wt.	Sl.	Sl.	Sl. Traf.	Sl.Er.Perm.	-
	Memphis	15								
	Other	25								
3	Falaya	60	Degree of limitation	Severe	Severe	Severe	Severe	Severe	Moderate	Slight
	Waverly	20	Limiting properties	Fl. Wt.	Perc.Fl.Wt.	Wt. Fl.	Wt. Fl.	Traf. Fl.	Fl.Wt.Perm.	Traf.
	Collins	15								
	Other	5								
4	Memphis	10	Degree of limitation	Slight to moderate	Slight to moderate	Moderate	Moderate	Slight to moderate	Moderate	Slight
	Loring	10	Limiting properties	Sl. Er.	Sl.Er.Prod.	Sl.	Sl.	Sl. Er. Traf.	Sl.Er.Prod.	-
	Ruston	25								
	Other	55								

1/ Abbreviation for limiting properties:

TSC - Traffic-supporting capability
Fl. - Flood hazard
Er. - Inherent erodibility
Wt. - Water table
Sl. - Slope
Perc. - Percolation rate
Perm. - Permeability rate
Prod. - Productivity
Traf. - Trafficability

Severe	Soils have one or more properties very unfavorable for a particular use; or there are problems present that are difficult and costly to overcome. Major soil reclamation work is generally required.

A summary rating is given for each association based on the dominant limitations. The ratings and limitations vary within each association depending on the specific soil.

LAND USE

Table 2.2 shows major land uses by land capability classes and subclasses for land in the Chickasaw Basin. The data indicates that land uses are distributed approximately as follows for the total basin area; 37 percent cropland, 16 percent pastureland, 25 percent non-federal forest land, 3 percent other, 4 percent federal lands, 14 percent urban buildup, 0.5 percent water areas and 0.5 percent unclassified areas. The major proportion, or 75 percent, of the cropland is on land capability classes I, II, and III. Pastureland is about equally distributed on land capability classes II, III, IV, VI, and VII. Over half of all the forest land is located on land capability classes IV, VI, and VII.

SOIL RESOURCE GROUPS

The basin soils were placed into several groups to evaluate their present and future production capabilities. These groupings were established by combining soils with similar resource problems and production capabilities. Present and projected budgetary information was developed for these soil resource groups and incorporated into a programing analysis to aid in establishing present and future production capabilities. Table 2.3 shows relative productivity by uses for land resource areas and major drainage areas.

Essentially all the agricultural lands in the basin are in the Southern Mississippi Valley Silty Upland land resource area except for 61,100 acres in the headwaters of the Wolf River which is in the Southern Coastal Plain land resource area. This relatively small area of more rugged land of the Southern Coastal Plains is 42 percent forest land and 32 percent cropland, the highest proportion of forest use in the basin and the lowest proportion of cropland.

The Wolf River drainage area contains over a third of the cropland and over half of the forest and pastureland in the total basin. Approximately 85 percent of the cropland, forest and pastureland in this drainage area is located in the Mississippi Valley Silty Upland land resource area with the remainder in the Southern Coastal Plains land resource area.

The Loosahatchie River drainage area contains nearly half the cropland and over a third each of forest and pastureland in the basin, all of which is in the Mississippi Valley Silty Upland land resource area.

The balance of the cropland, forest, and pastureland is located in the Nonconnah and Horn Lake drainage areas on the Mississippi Valley Silty Upland land resource area.

Table 2.2 - Land use by capability class and subclass (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Land capability class and subclass	Cropland	Pasture land	Forest land	Other	Total	Percent of total area
I	39,816	8,665	15,255	3,376	67,112	(6.7)
II	202,246	69,182	62,248	13,300	346,976	(34.7)
e	114,577	43,578	17,819	7,704	183,678	18.4
w	87,669	25,604	44,429	5,596	163,298	16.3
III	108,801	32,217	67,116	4,583	212,717	(21.3)
e	48,615	19,386	7,798	2,644	78,443	7.9
w	60,186	12,831	59,318	1,939	134,274	13.4
IV	71,550	27,765	26,165	3,640	129,120	(12.9)
e	47,842	23,225	21,887	2,454	95,408	9.5
w	23,708	4,540	4,278	1,186	33,712	3.4
VI	24,368	23,628	37,658	2,288	87,942	(8.8
VII	19,519	32,708	97,158	6,628	156,013	(15.6)
e	19,519	32,708	91,746	6,628	150,601	15.1
w	-	-	5,412	-	5,412	0.5
Total	466,300	194,165	305,600	33,815	999,880	

Total inventoried land		999,880
Federally-owned	43,200	
Urban area	167,800	
Water area	5,600	
Unclassified	5,420	
Non-inventoried land		222,020
Total basin area		1,221,900

Source: Conservation Needs Inventory - 1966, unadjusted data Tennessee and Mississippi.

4-30376

Table 2.3 - Relative productivity by land use, land resource area, and soil resource group, Wolf River drainage area (acres) 1/
Chickasaw-Metropolitan Surface Water Management Survey

Soil resource group	Cropland	Forest land	Pasture land	Other	Total
Southern Coastal Plains					
Well-drained upland	15,500	20,400	9,000	200	45,100
Good productivity	200	500	-	-	700
Average productivity	1,600	-	1,100	-	1,700
Poor productivity	13,700	19,900	7,900	200	41,700
Poorly-drained upland	-	-	-	-	-
Bottom land	4,000	5,100	6,900	-	16,000
Good productivity	-	-	-	-	-
Average productivity	3,800	3,600	5,600	-	13,000
Poor productivity	200	1,500	1,300	-	3,000
Subtotal	19,500	25,500	15,900	200	61,100
Miss. Valley Silty Upland					
Well-drained upland	89,700	95,300	64,600	11,200	260,800
Good productivity	54,500	11,400	23,300	3,400	92,600
Average productivity	18,500	9,800	13,000	2,000	43,300
Poor productivity	16,700	74,100	28,300	5,800	124,900
Poorly-drained upland	16,600	3,600	2,300	700	23,200
Bottom land	48,400	47,700	15,800	5,200	117,100
Good productivity	21,100	10,000	6,000	1,600	38,700
Average productivity	15,600	11,800	3,800	2,400	33,600
Poor productivity	11,700	25,900	6,000	1,200	44,800
Subtotal	154,700	146,600	82,700	17,100	401,100
Wolf River Basin Total	174,200	172,100	98,600	17,300	462,200

1/ Figures rounded to nearest hundred.

4-30376

Table 2.3 - Relative productivity by land use, land resource area, and soil (cont.) resource group, Loosahatchie River drainage area (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Soil resource group	Cropland	Forest land	Pasture land	Other	Total
Miss. Valley Silty Upland					
Well-drained upland	117,400	48,400	43,300	6,700	215,800
Good productivity	64,200	7,900	17,700	3,600	93,400
Average productivity	36,300	9,400	8,800	2,100	56,600
Poor productivity	16,900	31,100	16,800	1,000	65,800
Poorly-drained upland	19,100	1,200	4,600	-	24,900
Bottom land	86,500	57,600	13,900	5,300	163,300
Good productivity	12,200	6,200	3,400	1,700	23,500
Average productivity	40,700	18,500	7,600	2,400	69,200
Poor productivity	33,600	32,900	2,900	1,200	70,600
Loosahatchie River Total	223,000	107,200	61,800	12,000	404,000

Nonconnah and Horn Lake drainage areas (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Soil resource group	Cropland	Forest land	Pasture land	Other	Total
Miss. Valley Silty Upland					
Well-drained upland	41,000	14,900	26,600	3,800	86,300
Good productivity	17,600	4,300	8,900	1,100	23,900
Average productivity	7,900	1,900	3,300	200	13,300
Poor productivity	15,500	8,700	14,400	2,500	41,100
Poorly-drained upland	4,500	800	2,600	-	7,900
Bottom land	23,700	10,600	4,500	400	39,200
Good productivity	11,800	2,000	2,200	400	16,400
Average productivity	10,100	5,000	2,100	-	17,200
Poor productivity	1,800	3,600	200	-	5,600
Nonconnah Creek-Horn Lake Creek Total	69,200	26,300	33,700	4,200	133,400

4-30376

SURFACE WATER

The average annual runoff from the streams in the Chickasaw Basin is approximately 18-20 inches. During flood periods, the volume is mostly direct runoff, while ground water feeds the streams between rains. The percentage of total streamflow that is direct runoff or ground-water runoff varies among the streams of the basin, depending on the watershed characteristics. Porosity, depth of soil, slope, elevations, density and type of vegetation, and degree of urbanization affects the flow characteristics of these streams.

Figure 2.5 shows the 10-year average monthly discharge in inches for the stream-gaging station on the Wolf River at Rossville, Tennessee. An analysis of the stream-gage records shows that approximately 53 percent of the yearly runoff occurs during the winter months of December through March. The remaining 47 percent occurs during the months of April through November.

The Wolf River and Loosahatchie River are the two largest streams in the basin and are the only streams that have stream-gaging stations.

The gaging stations on the Wolf River at Rossville and on the Loosahatchie River at Brunswick have about the same drainage area behind the gages, but a large difference appears in the minimum average discharge. For instance, the minimum consecutive three-day average at Rossville is 103 cubic feet per second compared to 46 cubic feet per second at Brunswick. Flow can be expected to equal or exceed 97 cubic feet per second about 99.9 percent of the time at Rossville, and a flow of 46 cubic feet per second or above can be expected to occur 99.5 percent of the time on the Loosahatchie River at Brunswick. No detailed studies have been made to fully explain these differences, but it is assumed that the watershed characteristics are responsible.

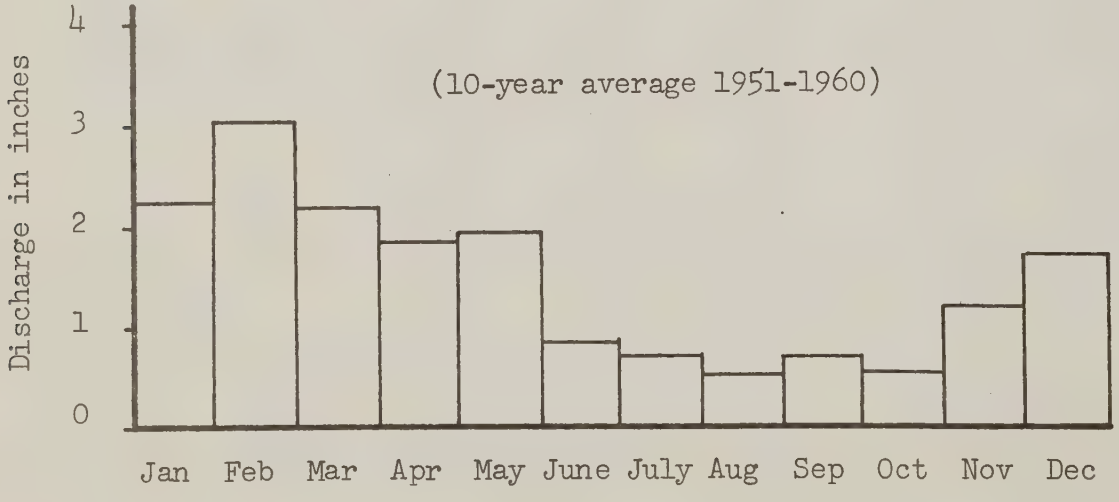


Figure 2.5-Average monthly discharge in inches Wolf River at Rossville, Tennessee - Chickasaw-Metropolitan Surface Water Management Survey

4-30376

The major consumptive use of surface water in the Chickasaw Basin is for livestock. There are many stock ponds in the basin that offer recreation such as boating, fishing, and picnicking. There are several sand and gravel operations that use stream water for washing sand and gravel. The waste-water, burdened with silt, is then returned to the streams. There is no other known industrial or municipal use of surface waters in the basin. The frequent flooding of some streams during winter months in the eastern portion of the basin provides good habitat for waterfowl.

GROUND WATER

The Chickasaw-Metropolitan Basin contains abundant ground-water resources, which are virtually untapped except in the Memphis area. The most important aquifers are the Claiborne and Wilcox formations. The other aquifers available in the southeastern part of the area include the Eutaw formation, the Coffee Sand, and the McNairy Sand. The Claiborne and Wilcox formations crop out at the surface in the southeastern part of the basin where they provide water for shallow domestic and farm wells. These formations are progressively deeper in the west. At Memphis, the Claiborne aquifer is known as the "500-foot sand" and the Wilcox aquifer is known as the "1400-foot sand". Most ground water production in the basin is from the Claiborne formation which furnishes water for domestic, public, and industrial supplies. Figure 2.6 shows the east-west geologic profile of aquifers in southwest Tennessee.

Wells range in depth from less than 100 feet to as much as 1,300 feet; however, the majority of wells presently being drilled are only a few hundred feet deep. Yields from wells in the basin range from a few gallons per minute from domestic and farm wells to as much as 1,600 gallons per minute from municipal and industrial wells.

Depending on location within the basin, the altitude of the base of fresh-water ranges from approximately 1000 to 2000 feet below mean sea level. The number of aquifers in the basin containing fresh-water ranges from three to four. In 95 percent of the basin, one or more of these aquifers remains untapped today. Some parts of the basin have two, and others three, untapped aquifers that could be used in the future. The chief reason that these aquifers are untapped is that good water is available at shallower depths and well owners are understandably reluctant to drill deeper because of the increased cost. Consequently, domestic and farm wells are generally developed at shallower depths except where relatively thick impermeable strata at or near the surface necessitates deeper drilling. The larger municipal and industrial wells are commonly developed in the deeper aquifers because of the need for larger capacities.

The quality of ground water is generally good, requiring little or no treatment. Some municipal and industrial supplies are treated for the removal of iron and carbon dioxide. This is usually done by aeration and rapid sand filtration. The addition of chlorine to kill harmful bacteria which may be present in the water is a common practice. All treatment is

in accordance with standards set by public health departments and pollution control boards.

Ground-water development in the Chickasaw-Metropolitan Basin is proceeding at a rate of about 600 new water wells each year. The majority of these new wells are for domestic and farm use and are small capacity wells. New municipal and industrial wells are for the most part replacement wells. In the past, the shallow-dug well with bucket or pitcher pump provided the necessary water for domestic and farm use, but with the modernization of farm homes and subsequent increased water use, drilled wells equipped with jet or submersible pumps, and in many instances deeper wells to provide adequate quantities of water, became a necessity.

The cost of wells ranges from approximately $750 to $1,000 for a domestic or farm well of average depth and diameter to several thousands of dollars for a municipal or industrial well. Costs are governed by the depth and diameter of the well, the static and pumping levels in the well, and the types of materials used in the construction.

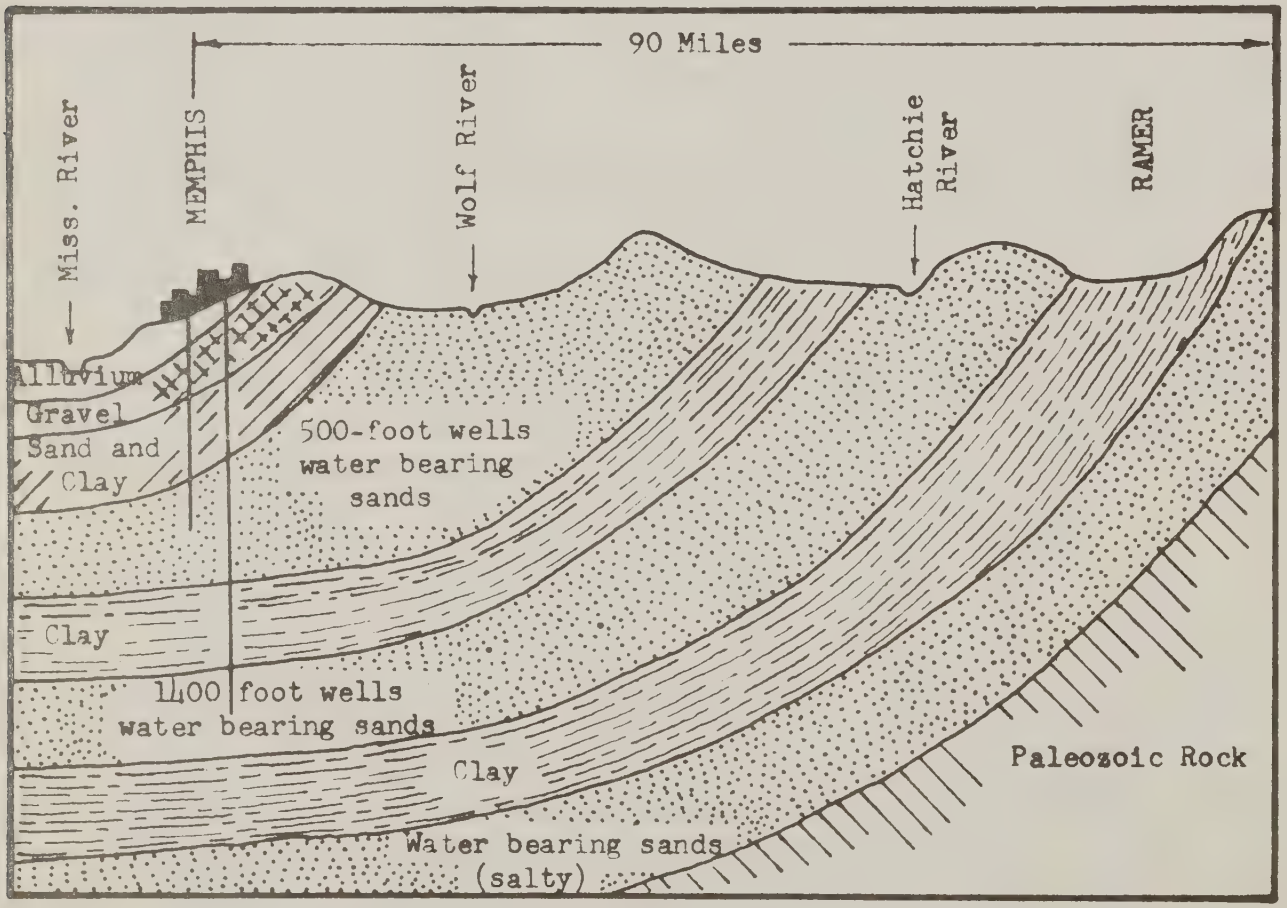


Figure 2.6 - East-West Geologic Profile showing aquifers in which abundant water supplies are available

4-30376

The Chickasaw-Metropolitan Basin lies atop the Mississippi Embayment, a bowl-shaped geological formation consisting of alternating layers of water-bearing sands and impermeable clay. Underground water supplies originate from rains falling on the sandy layers where they are exposed to the surface in a broad belt extending east from Memphis, across West Tennessee and West Kentucky. Since the elevation at which the water enters the sands is much higher than that of the sands under the basin, the water is trapped under pressure in huge natural reservoirs under the surface. Wells drilled through the impermeable clay into the 500-foot and 1400-foot water-bearing sands allow the water to rise to a point near the surface of the land. Water from the 2600-foot level is not desirable because it is salty.

Forest Resources

The relationship of the species of trees in the Chickasaw Basin forests to the soils on which they grow provides a key to understanding the nature of the existing and future forests. The forests are an ecological complex of soils, trees, and wildlife, none of which can be considered separately.

FOREST RESOURCE DISTRIBUTION

Forest land in the Chickasaw Basin is divided into two forest zones. These correspond to the Mississippi Valley silty uplands and the Southern Coastal Plain land resource areas. They are easily recognized as distinctly different zones. The Mississippi Valley silty uplands are primarily agricultural or urban and have about 30 percent forest cover (280,100 acres). This ranges from less than 20 percent in urban Shelby County, Tennessee, to 63 percent in rural Benton County, Mississippi. In the small area of Southern Coastal Plain, 42 percent of the land is forested (25,500 acres). In the upper part of the Wolf River, nearly 80 percent of the land is now used for forest. This figure has increased greatly in recent decades as small upland farms are reforested or allowed to revert naturally to trees.

FOREST SPECIES AND CONDITION

The surveys of forest resources for Tennessee and Mississippi set forth the amount of various tree associations in the Chickasaw Basin.

Figure 2.7 further identifies the difference in the forests. It is seen that the basin is largely in upland forest.

The bottom-land forest is two-thirds oak-hickory with the remaining third evenly divided between elm-ash-cottonwood and oak-gum-cypress. Upland forest is three-quarters oak-hickory. The remaining quarter of upland is about half oak-pine. Pine alone or cedar share the remaining upland.

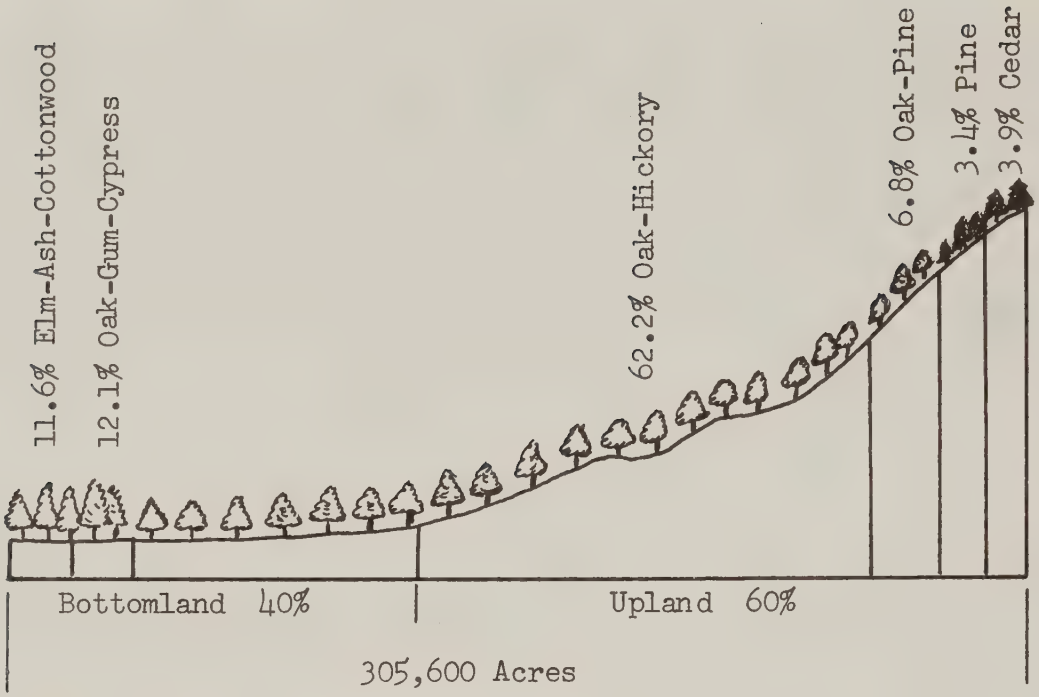


Figure 2.7 - Distribution of forest tree associations
Chickasaw-Metropolitan Surface Water Management Survey

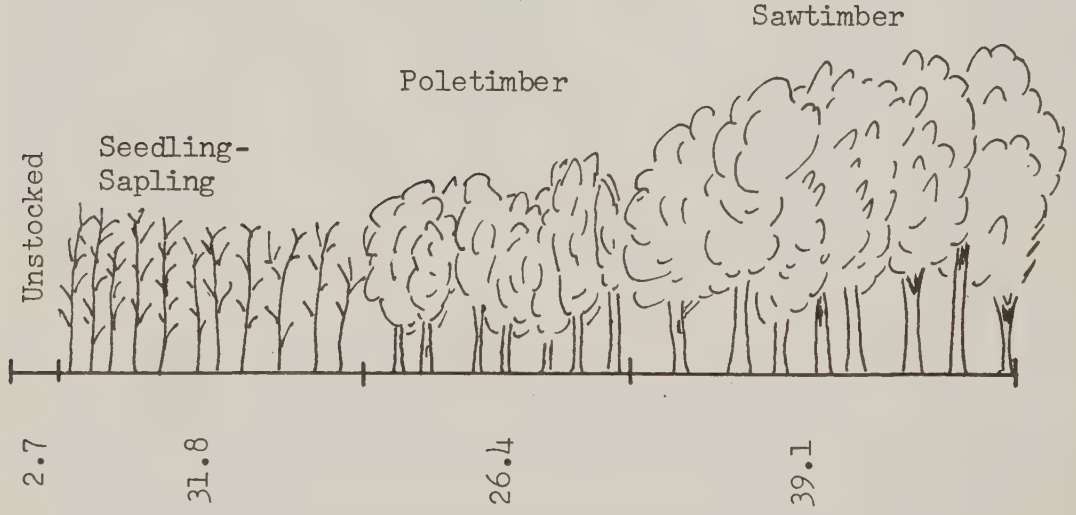


Figure 2.8 - Size classes of forest
Chickasaw-Metropolitan Surface Water Management Survey

Twenty-six percent of Chickasaw Basin forests is classified as poletimber size and 39 percent is sawtimber size. These figures show that there is now a substantial forest resource already established. Unlike some areas, this forest can be managed now rather than having to wait for seedlings and saplings to mature.

RELATIONSHIP OF TREES TO SITE

On the low, newly formed sandy soils where floods deposited coarse sediments, the initial tree species is usually willow or occasionally river birch. If the location remains low and swampy, the composition may become bald cypress and ash. As the soils mature and become somewhat drier, oak-gum-cypress forests develop. This forest type includes elms, maples, hackberry, and eventually overcup oak, water hickory, and persimmon.

In the event that continued sedimentation raises the soil level, it may support more oaks, including nutall oaks. Places where old stream beds are abandoned often follow this same forest succession pattern.

On the better drained immature soils, the first species might be cottonwood, followed by the elm-ash-cottonwood forest including sycamore, hackberry, box elder, and pecan. Later there would appear sweetgum, hickory, water oaks, and perhaps some cherry-bark oak. This latter succession is termed bottom-land oak-hickory. It is also found on the matured soils of the second bottoms with white oak, black tupelo, sweetgum, elm, ash, hickory, and cherry-bark, water, and shumard oaks, depending upon the degree of soil maturity and recurrence of flooding and sedimentation. Where flooding occurs late in the season without severe sedimentation, overcup oaks and water hickories are most prevalent.

Bottom-land soils of the smaller tributaries and creeks are usually influenced by coarser sediments transported only a short distance from the eroded upland. Water levels may fluctuate greatly during the year. Here are found beech, yellow poplar, magnolia, holly, and pine in association with the other hardwoods found on maturing non-flooded bottom-land soils. Most often these are narrow strips adjacent to stream courses where channel excavations have not occurred.

The upland area of the old Mississippi embayment has been deeply dissected over geologic times and has formed two areas with good timber growing potential. One of these is the area of brown loam bluffs with deep loessial soils in the downstream half of the basin. Much of this land has been cleared for agriculture.

Woodlands remain on patches of inaccessible land or in coves or ravines. Slopes are usually short but quite steep in the brown loam bluffs. Yellow poplar, cherry-bark, shumard, northern red and white oaks are found. There are also beech, elm, black oak, hickory, and dogwood.

In the upper basin the good upland sites are usually restricted to coves or ravines, or on slopes or bluffs above stream branches, and along minor

non-alluvial bottoms adjacent to small creeks. Upper slopes and ridges, where excessive erosion has not carried away the good surface soils, support white oak and acceptable stands of oak-hickory. When these otherwise good sites have been burned and eroded or grazed, blackjack and post-oak outnumber the more desirable species. Other areas of this upland, once under a loessial cap, have been so badly eroded that the best timber potential is restricted to pine.

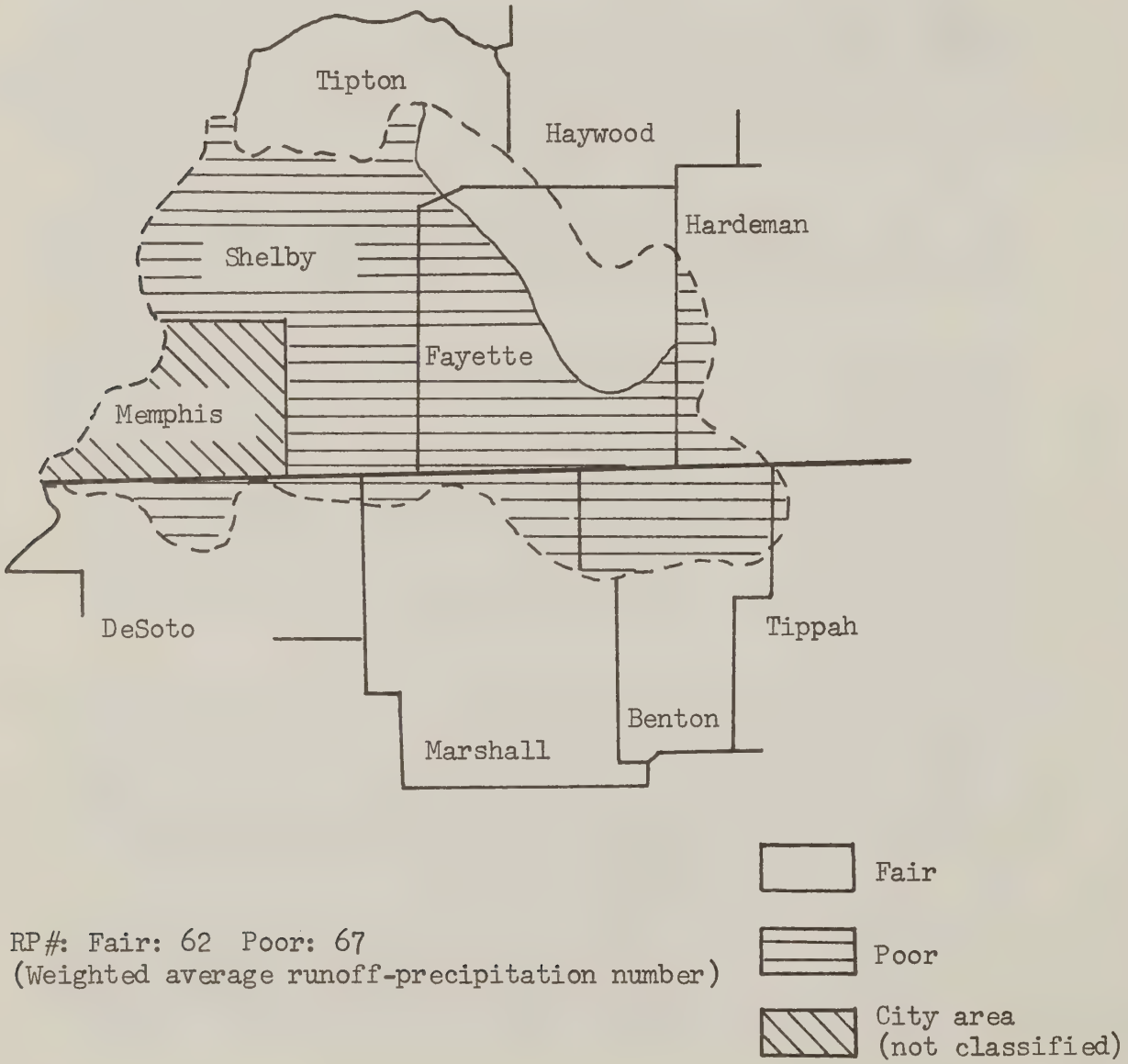


Figure 2.9 - Average forest hydrologic condition
Chickasaw-Metropolitan Surface Water Management Survey

The problems of fire, grazing, poor logging methods, and erosion are reflected by the large area of poor hydrologic condition.

4-30376

Mineral Resources

The known mineral resources of the basin are limited to the gravel, sand, silt, and clay deposits of the Tertiary and Quaternary ages. Sand and gravel deposits are present in ample quantities throughout the basin. They are being excavated by open-pit methods to supply the needs of highway construction and the concrete industry. The demand for sand and gravel is expected to increase to match construction needs of a larger population. Although geophysical prospecting and exploration for petroleum has taken place, there has been no oil or gas production in the basin. Clays of possible commercial value are known to occur in Hardeman and Fayette Counties, but they are not being utilized at the present time.

Fish and Wildlife

Fish and wildlife resources of the basin have suffered from the effects of a growing human population. Increasing land requirements for urban purposes, greater hunting and fishing pressures, increased pollution, and channelization of some streams have taken their toll of fish and wildlife resources. In spite of this, areas still exist that support abundant populations of fish and wildlife.

Chronic pollution of Wolf River downstream from the Germantown Road has nearly eliminated that segment of the stream for fishing. Fair fishing is available upstream from the Shelby County Penal Farm. Sunfish, carp, channel catfish, crappie, and bass are the common species.

Few Wolf River tributaries provide even fair fishing. Shaws Creek, Golden Creek, Grissum Creek, Clear Creek, Russell Creek, Hurricane Creek, Sand Creek, and Mary's Creek have intermittent flow and the middle and upper reaches are dry a large part of the time. Fishing potential is limited both by the low flows and lack of fish food organisms.

North Fork Wolf River has a minimum flow of 4.8 cubic feet per second, but is subject to heavy flooding. Average velocity is sluggish and moderate agricultural pollution is found in the stream. Normal color is slightly turbid. Availability of fish food organisms and fertility of the watershed is average. Fair fishing exists with sunfish, catfish, and carp being the principal species.

Nonconnah Creek has intermittent flow, upper reaches of the stream being dry most of the time. Severe industrial and municipal pollution is present in the lower reaches. There is no fishing present at this time and the potential is limited by pollution and low flow.

Loosahatchie River has fair fishing in the middle and upper reaches in Fayette County. This is a permanent stream with an average base flow of 20 cubic feet per second near Somerville. The river is subject to flooding. Average velocity is rapid and there is some agricultural pollution. Supply of fish food organisms is average. It is estimated that 85 percent

of the stream in Fayette County has been channelized. Major fish species are Kentucky bass, channel catfish, suckers, and sunfish.

In the lower reaches of Loosahatchie River in Shelby County, fishing is poor. This is due in part to pollution and past channel alterations. The stream is used for drainage and waste disposal. It is estimated that 90 percent of the stream channel has been altered. None of the tributaries to Loosahatchie River offer measurable fishing.

There are 3,128 ponds and lakes in the Chickasaw-Metropolitan study area, of which 2,940 are less than one acre in size. These ponds represent 6,124 acres of water that afford limited fishing opportunities. The majority of the ponds are used for stock watering and are relatively shallow.

One of the larger bodies of water is Herb Parsons Lake. This lake is owned and managed by the Tennessee Game and Fish Commission. It is a fee lake and a permit is required to fish. During the 1966-67 year, 117,500 fish weighing in excess of 30,000 pounds were caught by some 18,150 fishermen. The lake is 177 acres in size and supported 102.5 fishermen per acre. The harvest for fish was 171.3 per acre.

Wildlife resources in the Chickasaw Basin are generally limited to upland game species and migratory geese, ducks, and a few resident wood ducks. Table 2.4 gives the estimated population for the species most commonly found in the basin. These estimates are based on average populations, by land use, of the state of Tennessee, adjusted to conditions that exist within the basin area.

Table 2.4 - Estimated populations of wildlife species
Chickasaw-Metropolitan Surface Water Management Survey

Species	Population
Rabbit	285,000
Squirrel	538,000
Quail	139,000
Dove	226,000
Raccoon	23,000
Fox	4,000
Deer	16,000
Turkey	21,000

Many of these species can be found throughout the basin. However, the heaviest concentration of wildlife are found in Shelby Forest State Park, the Ensley Bottoms, and in the middle and upper reaches of the basin.

Ames Plantation is the site of the National Field Trials, which is said to be the number one bird dog event in the world. This annual event has been held at the Ames Plantation, located in the middle of North Fork of Wolf River Watershed in Fayette County, since 1903.

Quality of the Environment

Major elements which compose or affect the physical environment of the Chickasaw-Metropolitan Basin include water, air, fish, wildlife, land, waste disposal, noise, flood and fire hazards, recreational opportunities, the landscape, productivity of farm and forest, suitability of land resources for residential, commercial, and transportation uses, and the pattern of settlement and structures built by man.

The quality of surface water ranges from very good in some stream reaches to very bad in others. Water quality in the upper reaches of Wolf River is notable for its cleanliness, lending a favorable esthetic appeal when seen in its natural setting of trees and other vegetation. The lower reaches of all streams suffer pollution from silt, sediment, and municipal and industrial waste. Nonconnah Creek and Wolf River are polluted by clay washings from sand and gravel pits. This, in combination with industrial waste and, in the case of Nonconnah Creek, overflow of a municipal sewer, renders these streams repulsive to those who would enjoy outdoor recreation either on the water or along the banks. The greenways being acquired and developed along Wolf River cannot be enjoyed to their fullest until these conditions are corrected.

Farm ponds throughout the basin provide surface water of fair quality, depending upon the watershed conditions above them. Ponds with most of the watershed in trees or grass provide clear water in contrast to those which have eroding and intensively cropped watersheds where the water is muddy and less desirable.

As reported in the Memphis Commercial Appeal, April 5, 1970, sometime in the 1950's the air in Memphis became so soiled with impurities that it was no longer safe to breathe. Anything more than 80 micrograms of contaminating particulates per cubic meter of air is considered unhealthy, and in January 1958, the United States Health Department reported that the air in Memphis contained 94 micrograms. At the present time, a cubic meter of air averages 115 micrograms of particulates. While there have been no known chemical analyses made of the air outside the metropolitan area, it is believed that the air is less polluted and is not an environmental restraint.

The landscape of the basin is attractive and pleasing to the eye. Rural areas of the basin, with their gently sloping hills, broad valleys, and varied patterns of land use, possess esthetic qualities appealing to both city dwellers and rural residents. Evidence of improper land use, however, is also found within the basin. Occasional gullies, garbage dumps, and eroding roadbanks mar the scenic quality of the landscape.

Most visitors do not notice the blight to the landscape caused by urban expansion. The activities of man have created beauty within the urban environment, but his activities have also despoiled the landscape during

suburban development. Heavy earth-moving equipment is continually at work altering and defacing the landscape. Fortunately, most of these scars will be healed and in time become beautiful again.

Present waste disposal methods are a continuing source of pollution. In rural areas of the basin, garbage and solid wastes are often dumped into streams, gullies, or along roadsides. Within the metropolitan area, there are several waste disposal areas and sanitary land fills. Not all of these areas will meet U. S. Public Health Service minimum requirements. Waste disposal areas not only mar the rural and urban landscape, but they contribute to water pollution, produce an undesirable odor, and serve as a breeding ground for flies and rats. Residents living close to disposal areas have occasionally become outraged by odors, flies, and rats, and have demanded the closure of offending disposal areas.

III. ECONOMIC DEVELOPMENT

Economic conditions in the Chickasaw-Metropolitan Surface Water Management Survey area relate to the need for resource development in at least two ways. In the first place, the past, present, and expected future economic activity is a prerequisite to developing the expected future natural resource use and development needs. Secondly, political consideration is given to existing economic conditions in appropriating funds for resource development. The economic setting presented herein is related to past, present, and expected future resource use in this and later chapters.

General Analytical Procedure

The procedures for analyzing and projecting the general economy and the agricultural sector in the Chickasaw survey are basically the same. Secondary data were collected and historical trends were examined. Historical information was projected into the future and used as an initial guide in the development of projections. These initial projections were evaluated based upon the regional and national projections provided by the Water Resource Council and other related data. In some instances it was apparent that the historic trend would not continue, making modifications necessary.

Within the agricultural sector, linear programming was utilized as a tool to simulate the use of the agricultural land resource in producing food and fiber. This procedure provided: (1) a consistent framework for varying the determinant of agricultural production such as resource availability, basin food and fiber demands, crop yields and production costs to reflect expected future conditions; (2) a basis for developing expected land use adjustments with various resource development alternatives; (3) a framework for estimating economic efficiency gains under alternative assumptions about little-known factors in the future; and (4) as an aid in development of land use projections.

The reliability of projections of food and fiber or other related items, is directly related to the study area's size. The Chickasaw-Metropolitan Surface Water Management Survey and the Hatchie River Basin Survey are two small adjacent Type IV studies which the Department of Agriculture was participating in simultaneously. It was felt that the reliability of the analysis and the basic planning information provided for both basins could be improved by combining their areas. Therefore, for some anlaysis purposes these two studies were established as sub-areas within the combined area referred to as the Hatchie-Chickasaw River Basins.

ASSUMPTIONS

The projections of economic growth in the basin were developed under the following major assumptions: (1) sufficient quantities of water of acceptable quality will continue to be available in such a manner as to avoid being a constraint to economic growth; (2) no major depressions and reason-

ably full employment for the nation with a stable general price level; (3) a continued trend toward relative stability of the international situation with no significant worsening of the "coldwar" and no widespread outbreak of hostilities; (4) the basin's comparative advantage in producing goods and services will not be significantly altered through accelerated resource development; and (5) the production of food and fiber will continue to utilize the land resource as a basic input. In the event that any of these assumptions are violated, the conclusions would not necessarily be expected to hold.

LIMITATIONS

The national projections are thought to be representative of future conditions. However, the accuracy of any projection is not known and can only be developed within broad confidence limits. An allocation of national projections to sub-areas further reduces this confidence level. This is partly due to the fact that national projections are not influenced by interregional shifts, but regional and basin projections are dependent upon an assumed rate of change.

Realization of the limited confidence which can be placed in the projections emphasize that the projections should be viewed as directional trends only and not as absolute future magnitudes. If this fact is accepted, then credence can be added to the projections by evaluating the sensitivity of the proposed developments to variations in the projected economic indicators.

Secondary sources of historic data have been utilized in this report. Data from secondary sources are not always available for units below the county level. It was therefore necessary, in most cases, to divide the county data to represent basin boundaries. This procedure precludes the use of the historical data as precise figures, but is sufficient in establishing the basin in perspective. For these reasons, neither the historic nor future data presented can be viewed as exact enumeration.

General Economic Survey and Projections

HISTORY

The first Europeans to enter the land adjacent to the Mississippi River bluffs were Hernando DeSoto and his Spanish soldiers, when in 1541 they saw the great Mississippi River which the Indians called "Father of Waters". In 1673 Marquette and Joliette, the French explorers, visited the bluffs but found that the mound-building, sun-worshipping, Indians had vanished and a small but fierce tribe of Chickasaw Indians held the river bluffs and all the land now known as West Tennessee. The French attempted to control the Mississippi River, but the Chickasaws were implacable foes who resisted strongly and successfully. British colonial forces, soon to be American, acknowledged the Chickasaw claims and respected their intelligence and determination. After the Revolutionary War,

the United States continued to honor Chickasaw claims. In 1782, after the Louisiana Purchase, when American settlers north of the Ohio had spread west of the Mississippi River, the Chickasaw claim was felt to be seriously retarding westward movement. Late in 1818 a Kentuckian, Isaac Shelby, and a Tennessean, Andrew Jackson, purchased for the United States a small portion of Kentucky and West Tennessee. The Indians drove a hard bargain, selling for about $305,000.

Once West Tennessee was opened for occupation, settlement was extremely rapid. Pioneers came from nearby Middle Tennessee and from all the older sections of the United States. These people brought their possessions on keel boats out of the Tennessee, Cumberland, and Ohio Rivers, down the Mississippi. The necessity of filing title claims and of buying land at the territorial land office in Jackson, on the South Fork Forked Deer River, helped make this town the hub of West Tennessee settlement.

Travel was a major problem in West Tennessee until well into the twentieth century. There were very few connecting railroads between the regional and national trade centers. Later, when paths were widened through the dense forests, wagon roads were passable, although the soils of West Tennessee made roads almost useless during rainy weather. By the second decade of settlement, post roads connected the many communities with each other and the older sections of Tennessee. Early travel was largely by water, but even this was difficult. In 1828, a regular shipping route was established between Bolivar and Randolph, at the mouth of the Hatchie, to transport furs, settlers, and farm supplies. About 1839 the State Legislature authorized a canal to be built connecting the Tennessee with the Hatchie at the mouth of the Tuscumbia River which would regulate Hatchie streamflow and shorten the river distance from Middle Tennessee to New Orleans. Although this canal was considered feasible, political opposition toward internal improvements resulted in nothing being done.

Commercial agriculture in Southwest Tennessee began to develop in the 1830's. Cotton production was very profitable at this time and the land was adapted to this crop. This area grew well over half of Tennessee's cotton by 1840, with production doubling every five years until 1860. Farm sizes averaged between 200 and 300 acres, with land selling between $5 and $15 per acre for large tracts. About three-fourths of the farmers owned land. During this time the land was continually abused and a vicious chain of debt, over-extension, depression, and more debt enslaved agriculture in Southwest Tennessee, retarding progress until about the end of the Great Depression of the 1930's. Although cotton production continued to climb, income and property values remained depressed to about half of the 1860 level until after the turn of the century.

By the 1850's, progressive Tennessee farmers began to realize the wastefulness of reckless timber cutting and the highly erosive nature of the region's soils. Fayette County farmers organized one of the best agricultural societies in Tennessee, and an effort was made to preserve and restore the soil and to conserve the timber. Few heeded the warnings or

good examples of these early agricultural societies. Soil here was deep and fertile, and most farmers had too much uncleared fresh land to be concerned about growing gullies in exhausted fields. Conservation measures were slow-acting, promising no immediate cash return and only undetermined long-term benefits. Without enough money to buy the chemical fertilizers which became available after 1875, farmers could hardly be expected to afford restorative land treatment and crop rotations.

This era of land resource abuse that started after the Civil War, and the poverty and desperation that arose out of the Civil War, continues today. Massive gullies, over-cropped land, and poverty dwellings are still prevalent throughout the Southwest Tennessee area.

POPULATION

Basin population has increased in each 10-year period between 1940 and 1960. The population of 405,915 in 1940, increased to 667,502 in 1960, as shown in Table 3.1. The rate of increase was 29.8 percent for the ten-year period from 1940 to 1950, and 26.7 percent from 1950 to 1960. In 1940, approximately 73 percent of the total population was classified as urban. This increased to approximately 82 percent of the total population by 1960.

The urban population growth has been concentrated in Shelby County and is associated with the growth of the Memphis metropolitan area. The rural sector has realized little change in population in the last 20 years. Rural residents numbered approximately 111,000 in 1940 and approximately 117,000 in 1960.

These population trends give a distorted picture of some parts of the basin because they have been greatly affected by the growth of Shelby County. Therefore, an analysis by individual county is necessary. Three counties--Fayette in Tennessee, and Benton and DeSoto in Mississippi had all inhabitants categorized as rural in 1960. Five of the nine counties had a majority of their inhabitants classified as "rural farm" at this time, and all counties but Shelby had more rural than urban residents. This exemplifies the diverse setting in the basin. The city of Memphis will no doubt continue to grow and include an even larger percentage of the study area's population in the future. However, some predominantly rural areas will exist in the basin for some time to come.

Total population of the area is expected to continue growing, and this projected growth will be predominated by urbanites in the city of Memphis, as may be seen in Figure 3.1. The rural segment will probably not realize a large change in total inhabitants, but the relative importance of the rural segment will continue to decline. The population of the area is expected to be 1,014,500 by 1980; and by the year 2000, the population is projected to double. Although no significant change in the rural segment is expected, it will only represent nine percent of the total population by the year 2020 compared to 28 percent in 1960.

Table 3.1 - Summary of Economic Indicators: 1940-1960 and Projected 1980, 2000, and 2020
Chickasaw-Metropolitan Surface Water Management Survey

Economic Indicator	Historical			Projected		
	1940	1950	1960	1980	2000	2020
	Number	Number	Number	Number	Number	Number
Population						
Urban	294,682	413,276	550,564	882,600	1,377,600	2,075,200
Rural	111,233	113,611	116,938	131,900	141,900	153,000
Total	405,915	526,887	667,502	1,014,500	1,519,500	2,228,200
Employment						
Agriculture	23,352	17,802	9,531	6,600	3,800	2,700
Mining & Const.	8,640	14,720	15,420	22,600	33,100	48,800
Manufacturing	23,415	36,799	47,394	83,200	133,100	185,500
Services	93,158	132,477	163,951	252,800	377,000	565,200
Total	148,565	201,798	236,296	365,200	547,000	802,200
Income (1960 dollars)			Dollars	Dollars	Dollars	Dollars
Per Capita			1,390	2,400	4,200	7,200

These projected changes have two implications with regard to the land and water resources. First, urban encroachment upon rural lands will continue--possibly at an even faster rate than in the past. Second, the future demands for water for municipal and industrial water supplies, recreation, and pollution abatement may be greater than presently realized.

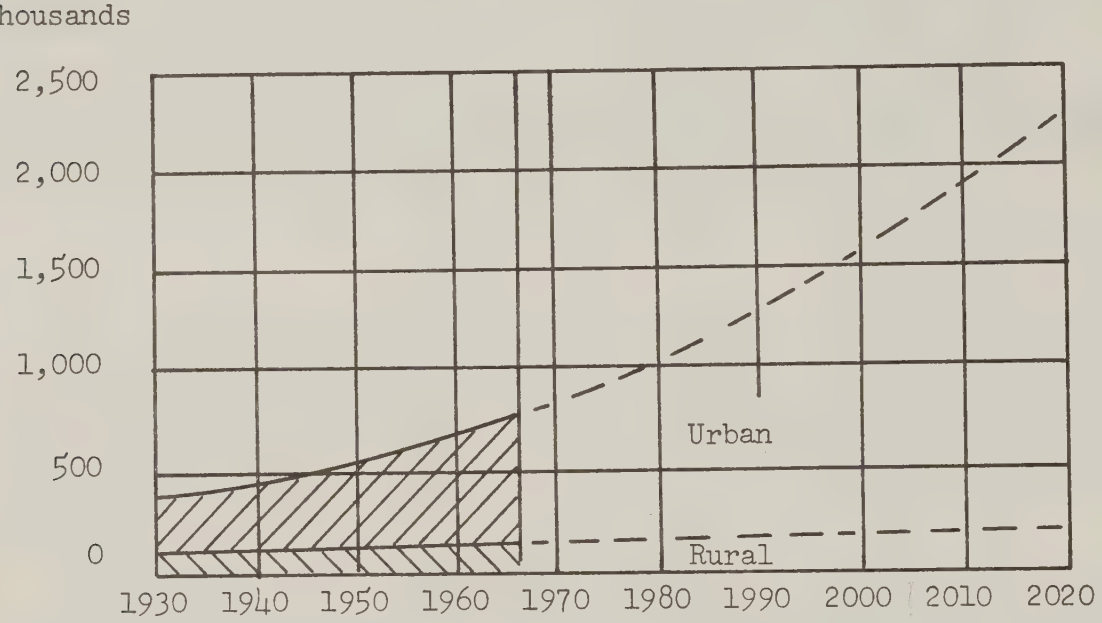


Figure 3.1 - Population - Past, present, and future
Chickasaw-Metropolitan Surface Water Management Survey

EMPLOYMENT

Employment in the basin was approximately 148,000 in 1940, 202,000 in 1950, and 236,000 in 1960. Between 1950 and 1960, employment increased approximately 17 percent, which is comparable to the national increase of 15 percent. The only major category to decline was agriculture, and the gains in other areas more than compensate for the decline in this category. This is shown graphically in Figure 3.2.

The largest employment group during the analysis period was the category representing all service industries with 69 percent of total employment in 1960. Employment in this group represents many industries including transportation, retail and wholesale trade, recreation and government. Service employment in the basin is highest in the following categories: wholesale trade, retail trade, private households, and medical and other professional services. Employment in manufacturing has increased in each of the past two decades and represented 20 percent of total employment in 1960. The major manufacturing groups are food and kindred products, furniture and other wood products, electrical machinery and miscellaneous manufacturing. Contract construction makes up the major part of employment

in the mining and construction category. This category represents seven percent of total employment in 1960 and has increased only slightly in the last ten-year period.

Agricultural employment accounts for only a small component of total employment in the basin - 4 percent in 1960. A decline of 24 percent was realized between 1940 and 1950, and 46 percent between 1950 and 1960. This exceeds the respective decline of 18 percent and 28 percent for the nation. Total employment is projected to be approximately 365,000 by 1980, and almost 547,000 by 2000. Agricultural employment is expected to continue declining proportionately and absolutely. The manufacturing and service sectors are expected to gain in employment proportionately as well as absolutely.

At the national level, industries which grow at a rate faster than total employment are referred to as growth industries. Based upon the change from 1950 to 1960 in national employment data, there were 15 growth industries which accounted for approximately 63 percent of total employment. The importance of growth industries within the basin provides some indication of the basin's future growth potential. In 1960, the basin had 68 percent of its employment in growth industries. Therefore, future employment gains are expected to keep pace with, or exceed, that of the nation as a whole. The situation could be further improved with the establishment of more growth industries and above-average performance of the non-growth industries in the future.

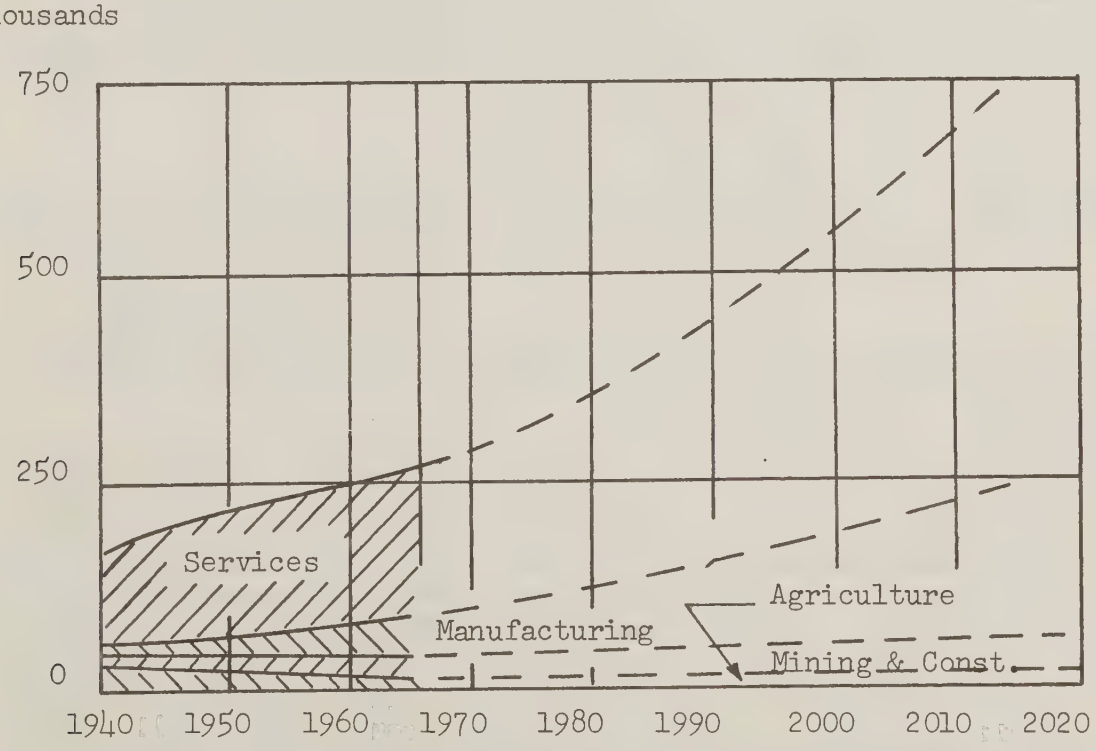


Figure 3.2 - Employment - Past, present, and future
Chickasaw-Metropolitan Surface Water Management Survey

4-30376

The economic activity of an area can be broken down into two components; production for consumption or use within the area, and production for export. The export of all goods, services and capital to any area beyond the boundaries of the basin is called "basic activity". This "basic activity" is the backbone of an area's economy, and the service activities are dependent upon it. Goods and services imported into an area create a deficit in payments and in the long run this deficit must be met through receipts from basic activity. The short-run balance between imports and exports varies from area to area and is dependent upon the area's comparative advantage.

A 1960 base-service ratio of 1:1.3 was developed based upon employment information in 30 industrial groups. This implies that, for every additional basic employee, an additional 1.3 employees will be required in the non-basic (service) sector. The two components of the ratio can also be added, giving an employment multiplier of 2.3. Utilization of the employment multiplier would assume a condition of full employment. In the previous analysis, no indication of extensive under-employment was found; and in the last 20 years, unemployment has not been a major problem. Therefore, the employment multiplier should represent future employment reactions under continued favorable economic conditions.

INCOME

The well-being of an individual or society has many different aspects and no one indicator will relate the whole picture. In this analysis, income was used as an approximation of "well-being" and basin income statistics were compared with regional and national data. In 1960, the median family income for the basin was $4,709 which was almost $1,000 below the comparable figure of $5,660 for the United States.

The disparity in income, in the drainage area, is directly associated with place of residence. The median family income for Shelby County was $4,903 in 1960. For the approximately 41,500 residents outside Shelby County it was estimated to be approximately $1,771 or almost $4,000 below the national average. A similar situation is reflected in rural and rural farm statistics for basin counties. Fayette County, which represents approximately 33 percent of the basin's land area, has an average rural farm income of $1,073.

Per capita income in the basin was estimated to be $1,525 in 1960, but was only $587 for non-Shelby County residents. Fayette County's per capita income of $470 is the fourth lowest per capita income in the United States. Anticipated economic conditions in the basin favor an improved average situation in the future. Per capita income in 1954 dollars is projected to be $2,600 in 1980, $4,400 in 2000, and $7,200 in 2020. These projections are based upon the assumption that the basin will gain comparability with the Lower Mississippi Region by 2020. The low income problem will become relatively less important because rural numbers are expected to decline. However, the disparity between rural and urban income is expected to continue.

LAND AND WATER RESOURCE BASE

The Chickasaw Basin contains 1,221,900 acres. There were approximately 222,020 acres of non-agricultural land in 1966; 43,200 acres of federal land, 167,800 acres of urban and built-up areas, 5,600 acres of small water areas, and 5,420 acres of other land and water. The other land includes part of an island in the Mississippi River used for industrial and agricultural purposes. Each of these uses, except other, is expected to increase in the future and total non-agricultural land use is projected to be approximately 266,300 acres in 1980, 366,300 acres in 2000, and 503,300 acres in 2020, Table 3.2.

Land available for agricultural production of food and fiber amounted to 999,880 acres in 1966. Assuming a constant land resource base in the future, the part available for agricultural production is expected to be approximately 955,600 acres in 1980, 855,600 acres in 2000, and 718,600 acres in 2020.

The location of the increase in non-agricultural land use was not determined. However, the general location of some non-agricultural uses indicate that the encroachment upon the productive croplands may be proportionately higher than upon the total agricultural land area. The present location of urban and built-up area has been influenced by both physical and economic forces. The desirable physical terrain of the bottom lands, plus the close proximity to production and river transportation, has resulted in most urban centers being located in areas with high agricultural production potential. The projected expansion of urban and built-up areas can therefore be expected to be proportionately larger on present cropland than land used for other agricultural purposes.

The land area projected to be covered by small water areas will be to a large extent on flood plain lands. However, the part of this flood plain which is presently under cultivation would depend upon reservoir locations.

TRANSPORTATION FACILITIES

Most basin residents live within a few minutes driving time of a major highway and none are farther than 20 miles from federal or state highways. All basin residents are within 100 road miles of Memphis, which has 10 airlines, 7 barge lines, 8 interstate bus lines, and 73 fixed route common carriers.

There are approximately 450 miles of federal and state highways in the basin, with 6 U. S. highways crossing the basin and merging at Memphis. Another 600 miles of hard-surfaced secondary roads, excluding city streets, are spread throughout the basin. Many more miles of gravel and rock-surfaced county roads traverse all the basin.

Basin residents are fortunate because of the array of major transportation facilities available. These facilities offer a variety of combinations of modes for economical shipping and travel.

Table 3.2 - Land use: 1966 and projected 1980, 2000, and 2020
Chickasaw-Metropolitan Surface Water Management Survey

Land Use	1966 (acres)	Projected 1980 (acres)	Projected 2000 (acres)	Projected 2020 (acres)
Non-agricultural	222,020	266,300	366,300	503,300
Federal 1/	43,200	49,000	57,000	65,000
Urban	167,800	205,000	296,000	423,000
Water	5,600	7,000	8,000	10,000
Other	5,420	5,300	5,300	5,300
Agriculture	999,880	955,600	855,600	718,600
Total area	1,221,900	1,221,900	1,221,900	1,221,900

Source: Conservation Needs Inventory

1/ Includes some National Forest.

Agricultural Economy

Changes in agricultural employment have been examined and projected. Other changes within the structure of agriculture have taken place and are analyzed in this section. Projections of agricultural land use and production are also presented. These projections establish a framework for evaluating the agricultural needs for water and related land resource development.

FARM ECONOMY

The farm economy of the basin has played an important role in the basin's economy in the past. It will continue to be important, but will assume a declining role. The value of all farm products sold was approximately 41 million dollars in 1964 with 78 percent coming from crops and the remainder from livestock and miscellaneous sources. Value of all farm products for 1964 was up 19 percent from 1959. In 1964, there were approximately 843,500 acres in farms which amounted to 69 percent of the total area and 84 percent of the agricultural land in the basin. Only 4 percent of the employed were in agriculture, but a substantial part of the other employment was in agricultural related activities. These activities range from transporting agricultural products throughout the marketing system at various stages of processing, to the processing itself. Memphis serves as a marketing and processing center for agricultural products for a large area including, but not limited to, the basin area.

Crop Production - Crop production in the basin serves as one of the major sources of agricultural receipts as well as an input to the livestock industry. Some specialization has developed in the area. However, due to favorable physical conditions, a large variety of crops are still grown. Over 90,000 acres of cotton and soybeans were harvested in the basin in 1966. This is shown in Figure 3.3.

Crops grown in the basin are divided into three main categories--oil and fiber crops, feed crops, and food crops. Soybeans and cotton are the major oil and fiber crops in the area and account for 67 percent of the total recorded crop acreage. Feed crops are second in importance; and feed grains, hay, and forage are harvested from 29 percent of the recorded crop acreage. The remaining four percent is devoted to the production of food crops, the major part of which is wheat and vegetables.

Cotton, which is the most important crop in the basin, was harvested on approximately 100,500 acres in 1964. Although this is a 43 percent decrease from the 1949 acreage, increased yields have resulted in a gradual increase in total production.

The only oil crop of major importance is soybeans. Soybeans increased from an incidental crop of approximately 6,000 acres in 1949 to a major crop of 94,000 acres, and second in acreage to cotton in 1964.

4-30376

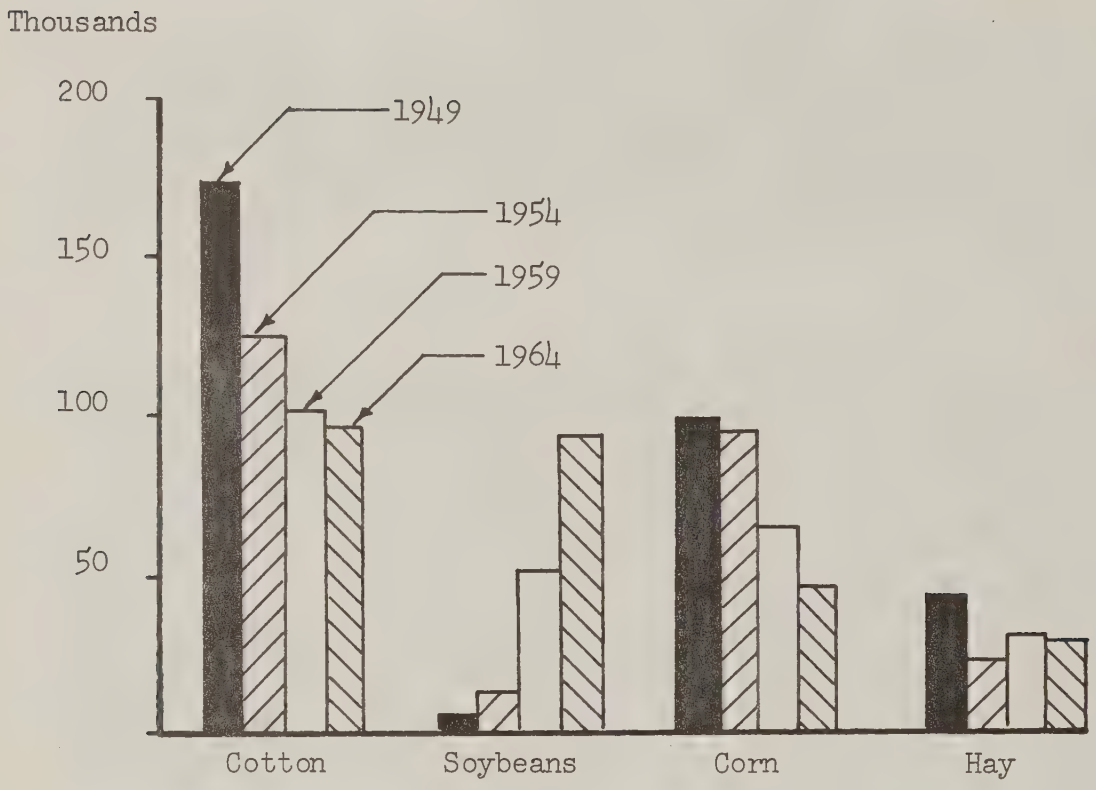


Figure 3.3 - Major crops harvested (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Feed crops are composed of feed grains, hay, and silage. Corn is the major feed grain; and in 1964 it was harvested on about 46,000 acres. This was a 34 percent decrease in acreage since 1959, but only a 19 percent decrease in production. Small acreages of oats, barley, and sorghum accounted for the balance of the feed-grain production. In 1964, about 30,000 acres were cut for hay. Lespedeza was the main hay crop with approximately 20,000 acres cut. Small acreages were devoted to clover and timothy, alfalfa, and other hay crops. Silage makes up the remaining feed-crop acreage. Corn silage is the most important, with about 4,000 acres harvested in 1964.

Vegetables were the most important food crop in terms of acreage in 1964. They were harvested from approximately 6,300 acres. A wide variety of vegetables were grown, but the largest acreage was devoted to production of cowpeas and tomatoes. Wheat was second in importance, with about 4,000 acres harvested in 1964. Double cropping of wheat and soybeans has influenced recent increases in wheat acreage. There were approximately 600 acres devoted to orchards in 1964, but only part of this acreage was of bearing age. Other food crops grown in the basin were sweet potatoes, Irish potatoes, and rye.

Agriculture plays an important role in the basin economy; 41 million dollars worth of farm products were sold in 1964.

Corn, the major feed grain, was harvested from 46,000 acres in 1964.

4-30376

Cotton has been king for generations but is being challenged by soybeans as the most important crop of the basin.

Soybean acreage has increased steadily since 1949 while cotton, corn and hay acreages have declined.

4-30376

Livestock and Livestock Products - Livestock and livestock products are of minor importance in the basin and little change has taken place in the livestock industry since 1950. However, some type of livestock is found on the majority of the farms. Approximately 80 percent of the farms have some cattle, hogs, and/or sheep; 63 percent have cattle, and 52 percent have hogs. Even though a majority of farms have livestock, they generally have a small number of animal units; in many cases, the livestock is utilized primarily for home consumption rather than sale.

Cattle and calves are the most important livestock group and this industry has gradually increased since 1949. In 1964, approximately 108,000 head of cattle and calves, and 32,000 hogs and pigs were sold alive. Approximately 3,240,000 dozen eggs and 39,605,000 pounds of whole milk and cream were also sold during that year. Livestock inventory numbers of approximately 108,100 cattle and calves, 33,000 hogs and pigs, 700 sheep and lambs, and 280,000 chickens 4 months and older were reported in 1964.

Other Elements of Economic Structure - One of the changes taking place within agriculture is the consolidation of farming units into larger operations. Declining product prices and rising production costs have required farm operators to increase production just to maintain past income levels, while some operators were even able to improve their economic situation by increasing their production per farm unit.

Increases in production were possible due to technological advances in two general areas. Crop yields per acre increased through various developments including improvements in seed quality, disease and insect control, and increased use of commercial fertilizers. The other general area of technological advance was the development of larger machinery and the mechanization of many labor consuming operations. Thus, an individual operator was able to farm a considerably larger number of acres. The average size farm was 70 acres in 1949, increased to 142 acres in 1964, and is expected to increase to approximately 340 acres by 2020 as shown in Figure 3.4. There were approximately 6,000 farms in 1964 and less than 2,000 farms are expected by 2020.

The process of consolidating farms into larger units can be expected to continue in the future. This change is both beneficial and detrimental with respect to the rural sector of the economy. It probably will improve the economic returns to the larger farm units, but the situation for the small farmers may be worsened. This may result because the low income situation is intensified for the farmer who lacks the capital resources and/or the managerial ability to expand or who, for some other reason, doesn't desire to expand. If the farmer's opportunity costs are relatively low because of age and/or nonfarm skills, his alternatives become limited. Many farmers attempt to supplement their farm income with off-farm work. Wage rates available to rural labor are low and even a dual source of income generally results in no alternative but to accept a relatively low level of income. The tenure of farm operators has gradually shifted in the direction of full and part ownership of the land

resource. However, the tenancy category was the largest in 1964 and accounted for 46 percent of all operators. Full owners increased to 34 percent in 1964 and part owners to 20 percent. Approximately 54 percent of the farm operators owned at least part of the land they farmed. The number of manager-type farms has never accounted for as much as one percent of all farm operators and has shown a steady decline.

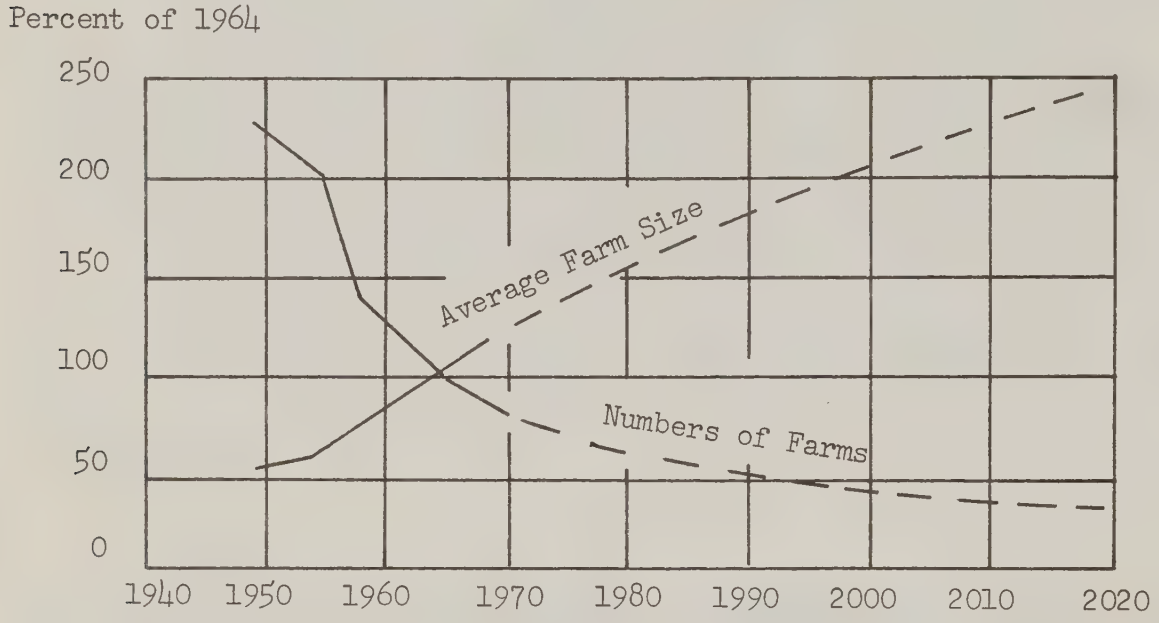


Figure 3.4 - Farm numbers and average farm size
Chickasaw-Metropolitan Surface Water Management Survey

Irrigation in this area is not an important production practice. In 1964, less than 50 farms had some irrigation, and less than 2,000 acres were irrigated. This is mainly due to the relatively high annual rainfall of approximately 50 inches. Most irrigation is presently utilized with intensive crops such as nursery crops and vegetables. It is not considered to be an economically feasible production practice for most field crops. The practice will probably continue in the future, and if the acreage of vegetables increases as expected, more acres will be irrigated.

FOREST ECONOMY

The forest products industry has a position in the Memphis industrial community that far surpasses the economic activity associated with the forest lands in this basin. Wood is even imported into primary, secondary, and specialty manufacturing plants from distant points.

The present and future value of the timber industry as generated by survey area forests is presented in Table 3.3. Slightly more than a quarter of a million dollars in annual stumpage in this basin results in the produc-

tion of 3¼ million dollars worth of timber products. This is a mere fraction of the Memphis wood products industry but reflects the basin generated portion. The projected value slightly more than triples by the year 2000. The projections are based upon expected harvest without improved management. This will result in mining of forest resources, forcing prices up and consumption down. None of these projections consider this basin's capability to produce the required wood for consumption on a sustained yield basis. This capability is discussed later.

Table 3.3 - Value of wood products: Present and expected value from wood harvested, 1962, 1980, 2000, and 2020 (1965 dollars)
Chickasaw-Metropolitan Surface Water Management Survey

Stage of Processing	1962 Dollars	1980 Dollars	2000 Dollars	2020 Dollars
Stumpage	277,300	537,800	877,300	924,100
Lumber and Veneer	186,100	248,200	331,000	362,000
Pulpwood	91,200	289,600	546,300	562,100
Harvesting *	415,900	806,700	1,316,000	1,386,200
Primary Manufacture *	1,067,600	2,070,500	3,377,600	3,557,800
Secondary Manufacture *	1,511,300	2,931,000	4,781,300	5,036,300
TOTAL	3,272,100	6,346,000	10,352,200	10,904,400

* Expansion factors of 1.5 for harvesting, 3.85 for primary manufacturing, and 5.45 for secondary manufacturing were used based upon national studies of economic activity in forest enterprise. No values for construction or marketing were considered.

The actual value of the basin's timber resources activity to the community is better reflected in the payrolls resulting from forest-based industry. Projected increases are due primarily to expected growth in pulpwood markets and associated harvest and production activities. Payrolls in pulpwood industries are expected to decline slightly after 2000 due to technological changes. Expected increases in lumber, veneer, and other hardwood-oriented activity, while not as spectacular as pulpwood, do show continued and steady growth.

Table 3.4 - Payroll Income: Present and expected value in payrolls received by employees from wood harvested, 1962, 1980, 2000, and 2020 (1965 dollars)
Chickasaw-Metropolitan Surface Water Management Survey

Activity	1962	1980	2000	2020
	Thou. Dols.	Thou. Dols.	Thou. Dols.	Thou. Dols.
Lumber and wood products	3,158	4,185	5,529	6,005
Pulp, paper and allied products	4,258	13,649	25,513	25,235
Forest management	258	577	1,408	2,885
TOTAL	7,674	18,411	32,450	34,125

Forest Ownership and Management - The 305,600 acres of forest in the Chickasaw-Metropolitan Basin is mostly in farms and other private holdings. Industry has only 920 acres (3/10 of a percent) while public ownership accounts for 32,335 acres including 11,840 acres of national forest in the Wolf River headwaters. All public ownership is slightly over 10 percent of the total forest land. Forest ownership is shown in Figure 3.5.

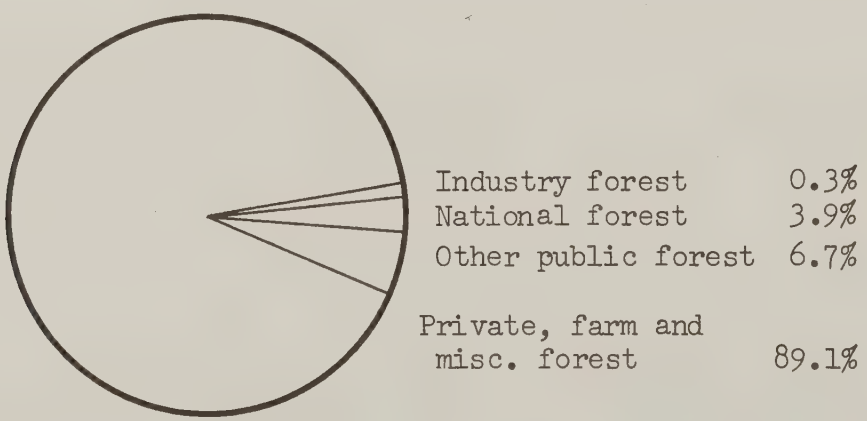


Figure 3.5 - Forest ownership
Chickasaw-Metropolitan Surface Water Management Survey

4-30376

Forest Volume, Growth, and Cut - The potential wood products contained in a forest are classified in two ways: growing stock and sawtimber. The growing stock classification is more representative of the whole forest. It includes the volume of all non-cull trees, and volume is expressed in million cubic feet, Figure 3.6. Growing stock volumes include all of the sawtimber, post, pole, and pulpwood sizes, and saplings large enough to measure 1" in diameter 4½ feet above the ground. The sawtimber classification applies only to trees large enough for sawlogs. The volume is expressed in terms of million board feet (MBM).

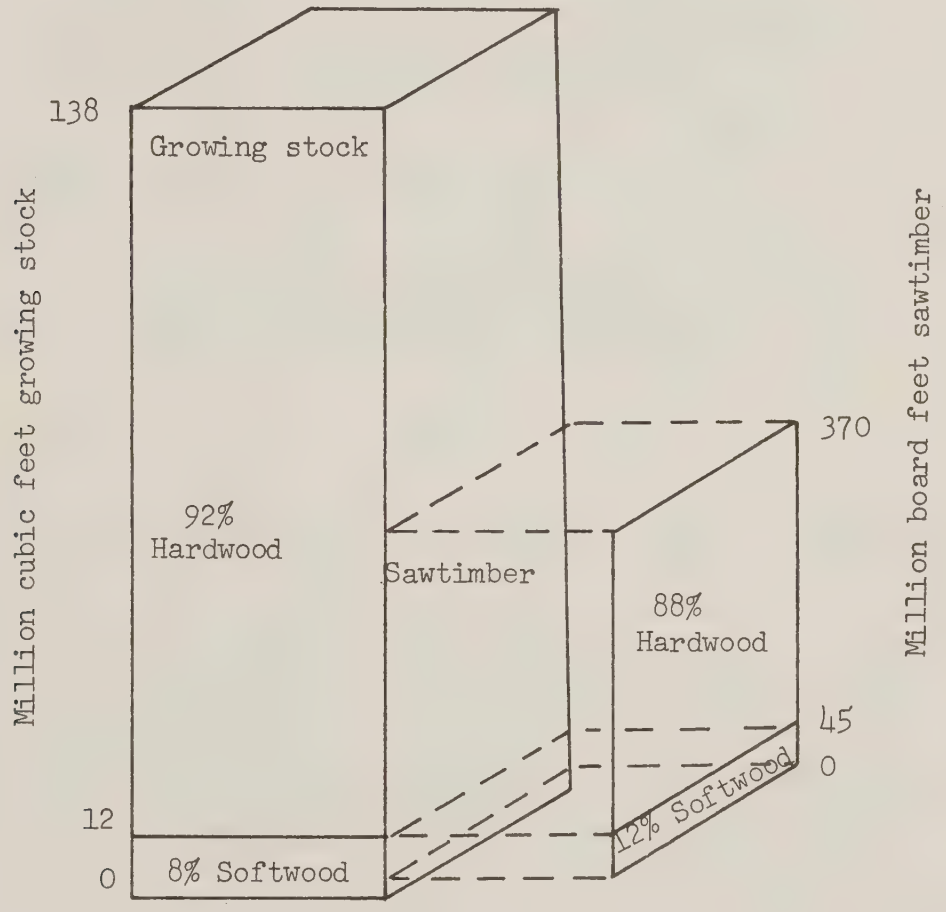


Figure 3.6 - Growing stock and sawtimber volume
Chickasaw-Metropolitan Surface Water Management Survey

Growing stock figures give an indication of the total forest makeup. They indicate how fully the forest is using the soil. Sawtimber gives an indication of the portion of growing stock that can be sawed for lumber. The basin forests today are primarily hardwood forests, with 47 percent of the

volume in sawtimber. The cubic foot volume and sizes of trees in the basin forests are well below forest capability. The volume of annual growth is also well below the potential, and can be increased until sites are fully utilized.

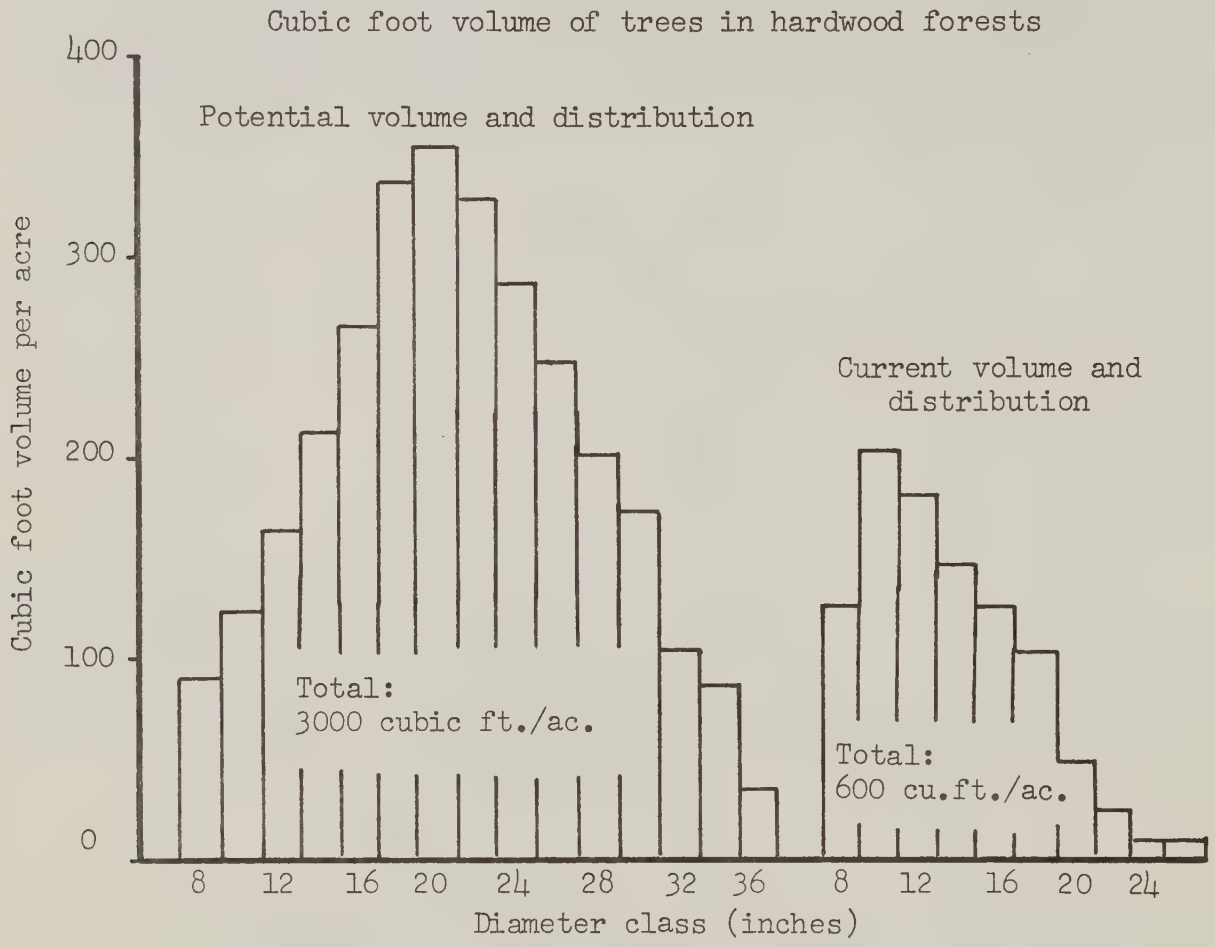


Figure 3.7 - Comparison of potential hardwood forest volume to actual current volume of hardwood basin forests
Chickasaw-Metropolitan Surface Water Management Survey

From the above figure it is apparent that basin forest land is capable of supporting considerably more volume in large individual trees. To grow more wood, this volume base needs to be allowed to increase. Figure 3.8 shows how the growing space available for tree growth is being used.

4-30376

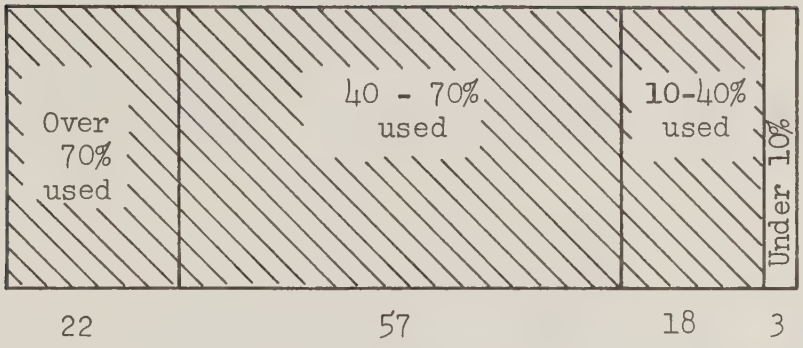


Figure 3.8 - Utilization of forest sites by trees-
All basin forest combined
Chickasaw-Metropolitan Surface Water Management Survey

About 1/5 of the forest land is fully stocked with trees using the available growing space; however, most of the forests are building toward full stocking.

Figure 3.9 gives the percent of the basin forests in several condition classes. Since 80 percent of the basin forests are classed in the two lowest classes, nothing more will be required than improving stocking. The stocking will have to be by useful trees. The major problem of the forest resource in meeting its projected requirements for industrial growth arise from two factors: (1) Failure of existing forests to fully use the soil potential for tree growth due to inadequate stocking and distribution of tree size classes, and (2) poor condition of the forest from the quality standpoint.

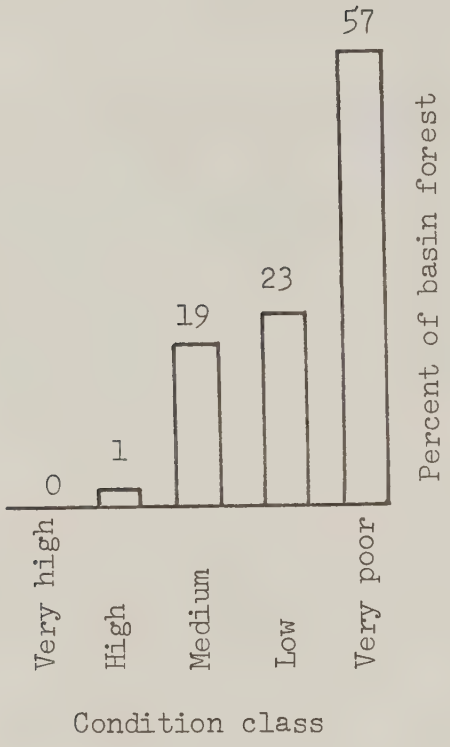


Figure 3.9 - Condition of basin forest
Chickasaw-Metropolitan Surface Water Management Survey

The non-yellow pine softwoods are being cut about 25 percent faster than they are growing. This means further reduction of the growth base and projected growth in this category. Total cut of sawtimber is 74 percent of the growth.

Growing stock growth totals 11.2 million cubic feet, Figure 3.10. Cut is 5.9 million cubic feet. For the sawtimber portion of this, growth is 30.3 million board feet and cut is 22.3 million board feet.

Forest Products and Related Employment - Forest production was analyzed in terms of four major product classes based on the eventual consumer. The first category--sawlogs--is that material sawed into lumber. Cordwood, the second category, includes material cut for pulpwood or fuelwood consumption. The third, veneer, is primarily the high quality logs peeled or sliced for boxes, furniture veneer, or paneling and plywood. The fourth category is other, which includes posts, poles, piling, cooperage, bolts, and miscellaneous industrial uses. The distribution of materials produced in the basin is shown in Figure 3.11.

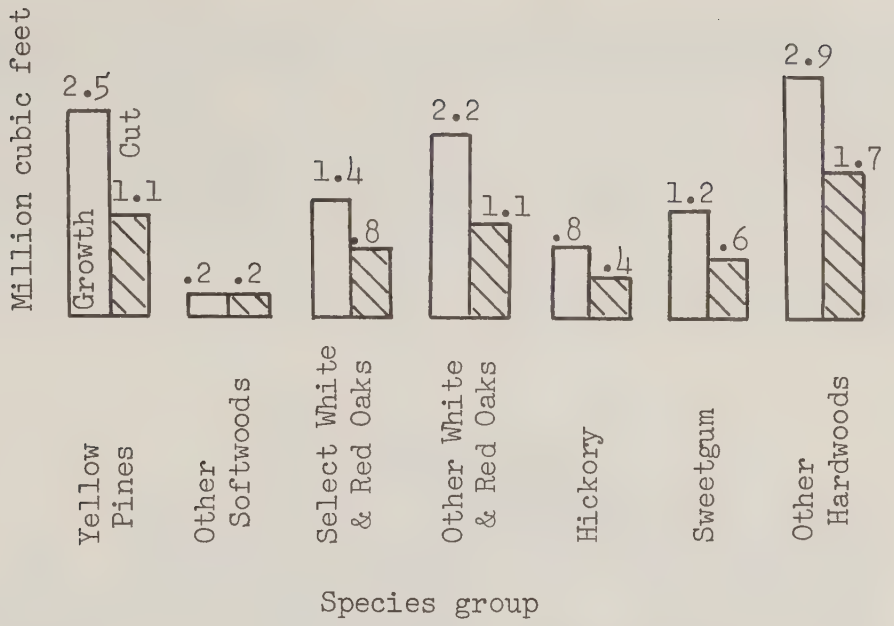


Figure 3.10 - Annual growth and cut of growing stock
Chickasaw-Metropolitan Surface Water Management Survey

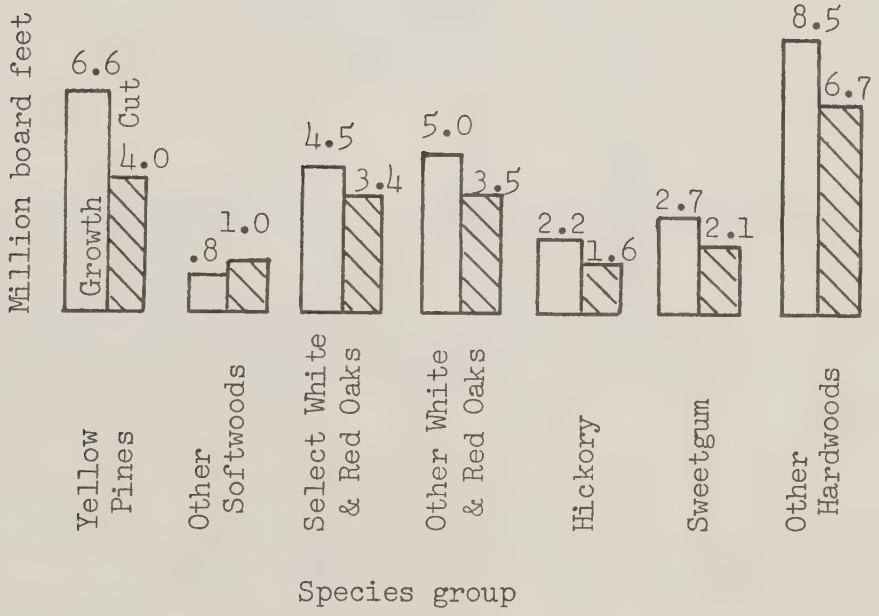


Figure 3.11 - Annual growth and cut of sawtimber
Chickasaw-Metropolitan Surface Water Management Survey

Based on Forest Survey studies in Western Tennessee and Northern Mississippi, the growth rates in terms of percent of the growing stock volume gave an indication of a 5.9 percent overall yield. This represents a weighted average of the softwood growth rate of 9.2 percent and a hardwood rate of 5.2 percent. The average annual cut in this area is estimated to be 4.2 percent of the growing stock. The cut by species group ranges from 42 to 67 percent with no species being cut in excess of growth. Overall, 53 percent of the growth of growing stock is being cut. Figure 3.12 shows the relationship by species group.

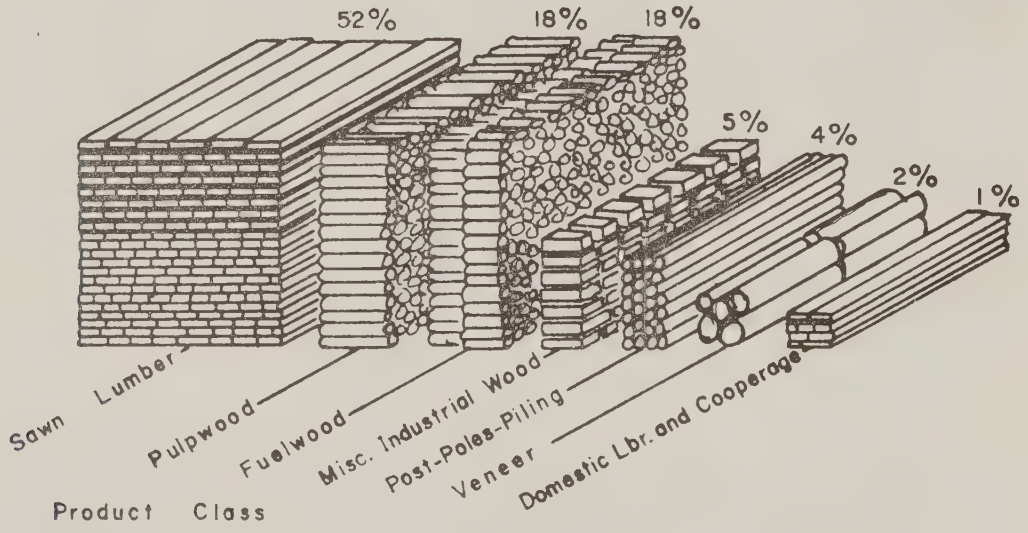


Figure 3.12 - Products of manufacturing plants
Chickasaw-Metropolitan Surface Water Management Survey

The most heavily cut species are the softwoods, other than the yellow pines. Part of the fact that the cedar and other softwoods are being heavily cut may stem from the specialized uses and very low volume of these species available. In the sawtimber category, the overcut is even more pronounced.

Nearly all forms of processing of wood products are represented in the Chickasaw Basin. Memphis, a major wood-using center, is the location for all types of processing except for the primary manufacture of wood pulp, which is done in nearby locations including Counce, Tennessee.

Employment in forest-based industries in the Chickasaw Basin has not increased in recent decades at nearly the rate experienced in adjacent areas, but it has exceeded the national average by 35 percent. The 4 percent per decade increase probably reflects continued growth in established industries while adjacent basins may have experienced new mill construction.

Wood-processing firms in Memphis increased from 10 firms in 1887 to 94 in 1958. There are 125 lumber or wood products firms in Memphis now with new mills being planned.

Projections of employment based on existing data indicate some shifting of employment from lumber and wood products to pulp, paper, and allied products, as shown in Figure 3.13. Totals are expected to climb to the year 2000 then drop to about the current level. This reflects the basic projection that overcut of basin forest resources will force local prices up and consumption down with long-term impacts on income and employment.

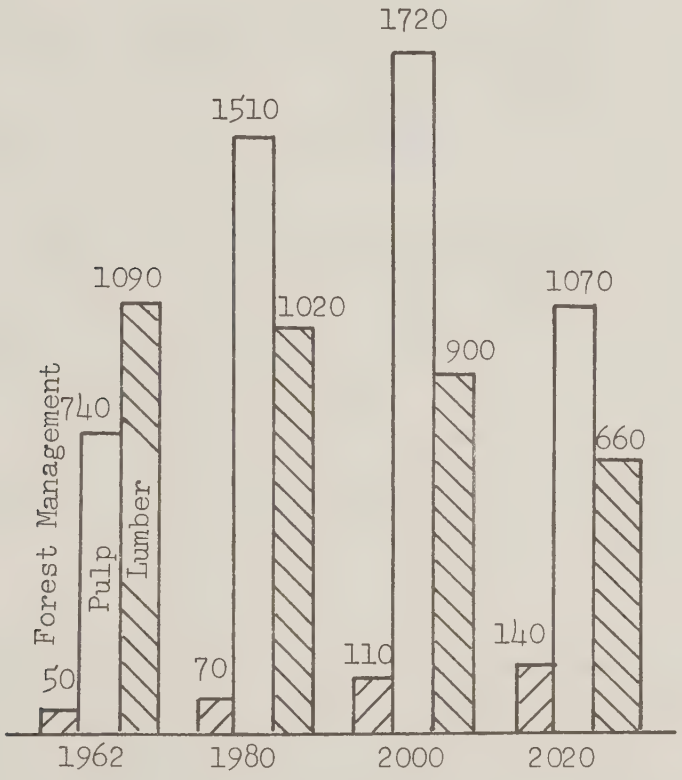


Figure 3.13 - Employment in forest-based industry
Chickasaw-Metropolitan Surface Water Management Survey

AGRICULTURAL LAND USE

The agricultural land resource base is declining because of preemptive non-agricultural uses. These uses include urban and industrial expansion, transportation facilities, recreational areas, and man-made reservoirs. Such uses are expected to reduce the agricultural base by 23 percent by the year 2020. This projection is based upon present trends and expected economic activity.

4-30376

A substantial change in the economic climate through resource development, or by some other means, would change the transfer rate from agricultural to non-agricultural uses.

The agricultural land resource is undergoing change with respect to ownership and use. Forest land is transferring from farm to commercial ownership, causing land in farms to decline. Cropland which is submarginal for crop production is transferring to other uses. A major part of this acreage is converted to woodland. These changes caused cropland, woodland in farms, and total land in farms to decline. Woodland in farms declined because transfers into commercial ownership were greater than the transfers from cropland to farm woodland.

Present shifts in land use are partially an adjustment from early settlement patterns and associated upland clearing operations to modern conditions. The topsoil was eroded from many of the upland acres cleared and placed in continuous rowcropping, and these acres are now submarginal for crop production.

Land use patterns are also influenced by technological advances. Improved seed, larger and more efficient machinery, improved management and the increased use of fertilizer and chemicals have allowed the agricultural sector to expand production faster than the demand of our growing population and export market. This fact, plus the development for crop production of additional highly productive lands through irrigation, drainage and flood protection, has forced many acres of land marginal for crop production into other uses. This situation is national in scope, but has had its influence in this area. The impact of these influences becomes more apparent as historical data on land use and crop and livestock production are analyzed.

An inventory of the land resource showed that approximately 44,000 acres, or approximately 18 percent, of the Class VI-VII land was used for cropland in 1966. The amount of cropland in these classes was probably even higher in prior years. The transfer of this land to uses other than crop production, plus the declining need for cropland on a national scale, has caused the large change in land use on farms. Some bottom land has been cleared, but not enough to balance the reduction in upland cropland.

Recent practices in the basin, with respect to soybean production, have influenced the 1964 cropland harvested data. In the last few years, high soybean prices have caused operators to cultivate acres previously diverted from crop production. This practice is profitable partly because the productivity level of the diverted acres has increased. Continuous row-cropping, with present practices, will reduce the land's productivity level and the land will again prove to be submarginal for crop production. Some of the land in the soybean production will probably be diverted again in the near future.

All of these influences have complicated the interpretation of past cropland use changes and would make projection of land use categories based

entirely upon historical trends questionable. However, projections based upon a 1949-1954 trend of agricultural census data were developed. An extension of these trends would result in a rapid decline of most uses and very little land in some agricultural uses by 2020. For example, land in farms would decline to approximately 500,000 acres by 2020. Many of these changes are much sharper than what is expected to happen and do not reflect national guideline land use projections.

Projections of land use were also developed based on the minimum costs of producing the Hatchie-Chickasaw Basin's share of future food and fiber requirements. This was accomplished by utilizing a least cost linear programming model. Agricultural land use projections were developed from the results of these two projection procedures plus the national and regional guideline projections available on land use. These are shown in Figure 3.14.

Agricultural land uses were projected into the future, based upon an assumed level of demand for food and fiber and the assumption that there is no acceleration in the rate of resource development. If accelerated resource development occurs, then additional land use adjustments would be expected.

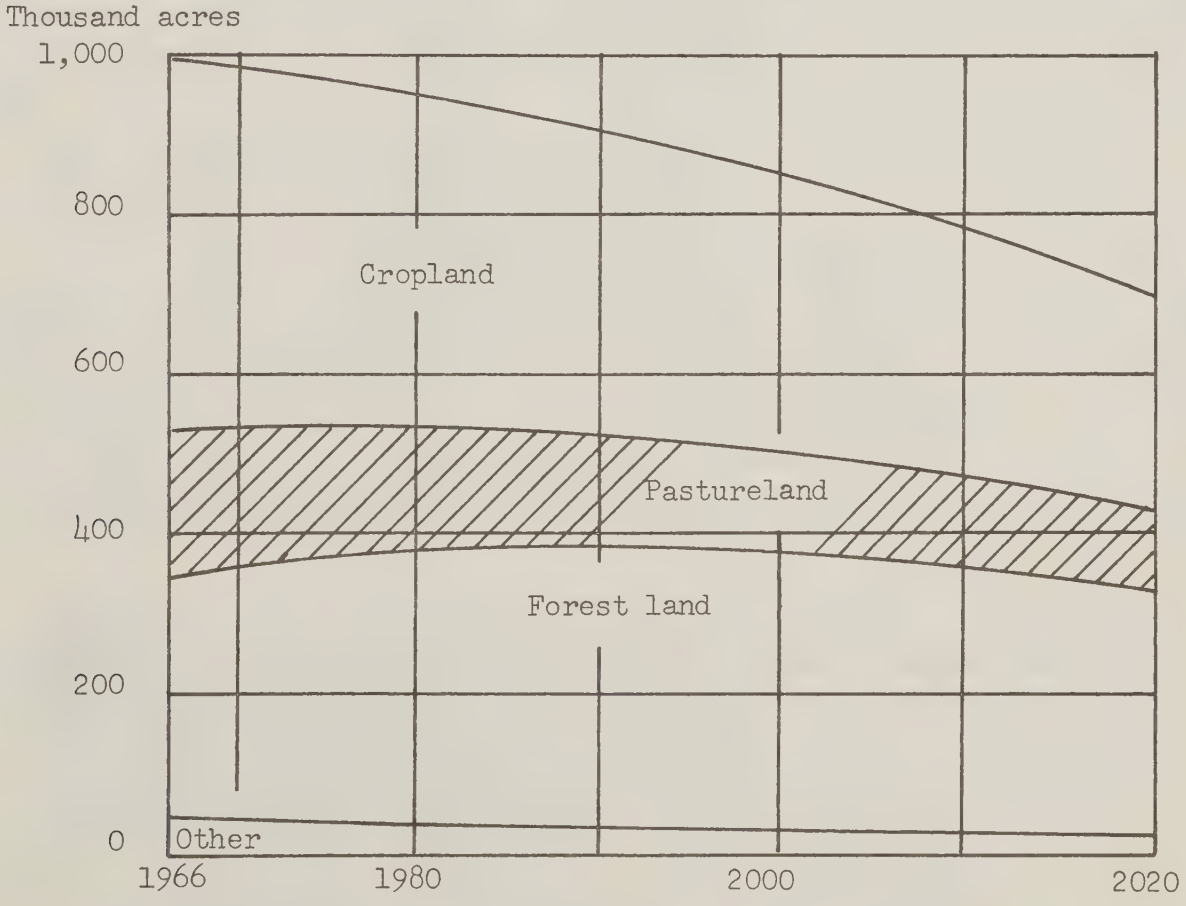


Figure 3.14 - Projected agricultural land use
Chickasaw-Metropolitan Surface Water Management Survey

4-30376

FOOD AND FIBER

From a national economic viewpoint, development to attain projected levels of production of food and fiber may be justifiable for two different reasons. First the land or water resource may be a limiting factor and resource development would be needed for the basin to produce at the projected level. Secondly, increased yields and land use changes resulting from resource development may result in reduced production costs which more than pay for the development costs.

National projections of future food and fiber were developed through analysis and projection of domestic consumption, industrial use, and export-import balances. These projections reflect the quantity of food and fiber which would be demanded under existing prices. The projections reflect series "C" population projections which are based upon a birth rate comparable to that experienced in 1967. This is substantially below the birth rate which existed in the 1962-1965 period.

Regional projections are further developed based upon historical national-regional relationships and expected shifts in these relationships. The Chickasaw-Metropolitan Surface Water Management Survey and the Hatchie River Basin are both in the Lower Mississippi Water Resource Region and projections of the demand for agricultural products for these two basins were developed, based upon their relationship to this water resource region, and are presented in Table 3.5.

This procedure implies that fiber and oil crops, the most important crops historically, will continue to be of major importance. The pressures of increased population, exports, and industrial uses will cause the demand for both of these commodities to increase in future time periods. The quantity of cotton produced in the basin is projected to be 249,000 bales in 1980, which is about 28,000 bales above the 1966 level. Production is expected to register a gradual upward trend and the reduction in the cotton acreage base is not expected to be as much as in the past. Projected change in the national demand for soybeans is proportionately higher than for many other commodities. Much of this increase is expected to come from the Lower Mississippi Region. The quantity produced in the area for 1980 is expected to be approximately 7,700,000 bushels or approximately double 1964 production.

Feed crops are not expected to increase significantly. Corn is the most important feed grain. Although the historic downward trend in production is expected to reverse, increased yields will allow acreage to continue to decline. Oats have been of minor importance and are not projected to change much in total production. Hay production is expected to increase, but not in proportion to the increase in the 1980 projection for beef and veal. At least some of this deficit will be accounted for by increases in silage and winter pastures.

Food crops are of relatively minor importance with respect to acreage, but are expected to increase in importance in the future. Vegetable

production is expected to increase since some capital investments for vegetable processing facilities have already been made in the general area.

Projections of the quantity of wood products reveal some shifts in the wood product mix. Today over 60 percent of the cut goes into sawtimber, veneer, and miscellaneous products. This is expected to be reduced to under 45 percent of the total cut in the year 2020 and pulpwood will become the major product. While this shift takes place, total volume will increase in excess of 250 percent. The rapid growth of population and expanding per capita use of paper products will force pulp production upward.

Table 3.5 - Current (1966) and baseline projections of production, selected commodities
Chickasaw-Hatchie River Basins, 1980, 2000, 2020

Commodity	Unit 1/	1966	1980	2000	2020
Cotton	Bale	221,283	249,000	278,000	298,000
Corn	Bu.	4,689,750	4,403,000	5,351,000	5,902,000
Soybeans	Bu.	6,772,290	7,692,000	9,405,000	10,834,000
Wheat	Bu.	482,925	484,000	577,000	603,000
Oats	Bu.	99,225	117,000	61,000	37,000
Veg.-Com.	Cwt.	341,349	449,000	507,000	540,000
Hay	F.U.	64,176,000	88,061,000	96,699,000	95,318,000
Silage	F.U.	64,542,400	86,611,000	95,104,000	93,323,000
Pasture	F.U.	387,262,800	612,603,000	672,436,000	639,188,000
Beef & Veal	Lbs.	57,456,295	89,420,000	107,901,000	115,232,000
Pork	Lbs.	29,878,392	42,568,000	48,534,000	51,832,000
Milk	Lbs.	74,732,172	104,612,000	125,651,000	135,945,000
Eggs	Doz.	8,264,876	12,988,000	17,618,000	22,087,000
Sawtimber	Cu.Ft.	13,000,000	16,500,000	21,000,000	26,600,000
Cordwood	Cu.Ft.	5,500,000	16,800,000	30,100,000	29,000,000
Veneer	Cu.Ft.	500,000	700,000	900,000	900,000
Other wood products	Cu.Ft.	1,900,000	2,500,000	3,100,000	3,200,000

1/ F. U. stands for feed units equivalent in food value to one pound of corn.

Hardwoods are now cut primarily for sawlogs and veneer. Softwoods are cut for sawtimber, poles, and piling. Only 7 percent of the hardwood is cut for pulpwood. This will increase. Hardwood accounts for most of the posts. Cooperage accounted for less than 1 percent of hardwood cut.

Livestock production is projected to increase, and beef and veal, milk, and eggs are expected to be the major production items. Historic increases in pork and broiler production are also expected to continue.

4-30376

RECREATION

Basin residents participate in many different types of recreational activities. Some of the more important ones which involve the use of the land and water resources are hunting, fishing, boating, swimming, picnicking, and camping. Others such as canoeing and sightseeing exists, although little development for these activities has taken place.

Recreation supply, demand, and needs for three activity groups - water-oriented recreation, hunting, and fishing - were evaluated. Demand was based upon historic participation at zero price to the user. The water-oriented recreation activities (boating, swimming, camping and picnicking) were evaluated for the Chickasaw-Hatchie River Basins and the supply, demand, and needs for both basins are presented in Table 3.6.

Table 3.6 - Water-oriented outdoor recreation demand, supply, and needs, present and projected
Chickasaw-Hatchie River Basins

Year and activity	Activity occasions		
	Demand	Supply	Needs
1965			
Boating	1,394,600	708,500	686,100
Swimming	1,545,800	1,779,200	-
Camping	369,700	134,000	235,700
Picnicking	1,999,500	894,000	1,105,500
Total	5,309,600	3,515,700	2,027,300
1980			
Boating	1,767,900	708,500	1,059,400
Swimming	1,959,600	1,779,200	180,400
Camping	468,600	134,000	334,600
Picnicking	2,534,700	894,000	1,640,700
Total	6,730,800	3,515,700	3,215,100
2000			
Boating	2,307,400	708,500	1,598,900
Swimming	2,557,600	1,779,200	778,400
Camping	611,600	134,000	477,600
Picnicking	3,308,200	894,000	2,414,200
Total	8,784,800	3,515,700	5,269,100
2020			
Boating	3,077,500	708,500	2,369,000
Swimming	3,411,200	1,779,200	1,632,000
Camping	815,700	134,000	681,700
Picnicking	4,412,300	894,000	3,518,300
Total	11,716,700	3,515,700	8,201,000

4-30376

The supply of water-oriented recreation comes from 11,455 acres of lakes, reservoirs and streams; 10,356 acres of surface water in the Mississippi River suitable for recreation; and 132,881 acres of land. This includes both public and private resource ownership which provided 3,515,700 water-oriented activity occasions in 1965. Demand for these activities totaled 5,309,600 activity occasions in 1965, and is projected to be 6,730,800 in 1980; 8,784,800 in 2000; and 11,716,700 in 2020. This represents a 27 percent increase by 2020.

The demand, supply and needs for fishing in the Chickasaw Basin, presented in Table 3.7, reflects a sharply increasing demand versus a constant supply. Some additional facilities for activities such as swimming and picnicking will probably be developed by local entities. However, due to the population trend and urbanization in the Chickasaw Basin, supply is not expected to meet projected demands. The Hatchie Basin will be expected to supply the major part of the "out-of-basin" demand for the Chickasaw. The totals in Table 3.7 reflect the demand, supply and need of both basins.

Table 3.7 - Fishing demand, supply, and needs-present and projected Chickasaw-Hatchie River Basins

Year/Basin	Man-days		
	Demand	Supply	Need
1960			
Chickasaw	1,272,767	304,501	986,266
Hatchie	378,748	111,465	267,283
Total	1,651,515	415,966	1,253,549
1980			
Chickasaw	1,845,340	304,501	1,540,839
Hatchie	391,734	111,465	280,269
Total	2,237,074	415,966	1,821,108
2000			
Chickasaw	2,736,982	304,501	2,432,481
Hatchie	335,588	111,465	224,123
Total	3,072,570	415,966	2,656,604
2020			
Chickasaw	3,983,091	304,501	3,678,590
Hatchie	308,770	111,465	197,305
	4,391,861	415,966	3,875,895

Present and projected demands, supply, and needs for hunting game birds and animals, including waterfowl, in the combined Chickasaw and Hatchie Basins were developed by the Tennessee Game and Fish Commission in cooperation with the biology work group. This data is presented in Table 3.8.

Table 3.8 - Hunting demand, supply and needs, present and projected
Chickasaw-Hatchie River Basins

Year/Basin	Man-days		
	Demand	Supply	Need
1960			
Chickasaw	390,239	280,288	109,946
Hatchie	209,793	523,910	-
Total	600,032	813,198	-
1980			
Chickasaw	562,435	259,381	303,054
Hatchie	255,655	545,270	-
Total	818,090	804,651	13,439
2000			
Chickasaw	795,674	221,452	574,222
Hatchie	295,805	544,871	-
Total	1,091,479	766,323	325,156
2020			
Chickasaw	1,121,300	172,083	949,217
Hatchie	333,920	540,167	-
Total	1,455,220	712,250	742,970

According to an unpublished report, Fish and Wildlife Resources of the Hatchie and Chickasaw-Metropolitan Drainage Basins, June 7, 1968, prepared by the Tennessee Game and Fish Commission, there were 18,600 hunters in the basin in 1960. These hunters made 245,740 trips for small game, harvesting 172,000 squirrels, 163,200 doves, 182,500 quail, 114,900 rabbits, and 17,000 raccoons. The following table shows the hunting by percent, average trips per season, and number of kills per trip.

Table 3.9 - Small game hunting
Chickasaw-Metropolitan Surface Water Management Survey

Types of hunters	Percent of hunters participating	Trips per season	Kill per trip	Total hunters
Squirrel	62	6.2	2.4	11,538
Dove	27	5.6	5.8	5,025
Quail	46	8.2	2.6	8,561
Rabbit	56	5.8	1.9	10,422
Raccoon	12	6.9	1.1	2,234

4-30376

Total number of waterfowl, deer, and turkey hunters after adjustments for out-of-state hunting include 972, 1,010, and 89 respectively. The average waterfowl hunter made 5.2 trips per season and killed 1.1 birds per trip. Deer hunters made 3 trips per season and killed 0.058 per trip. Turkey hunters made 2 trips per season and killed 0.04 per trip. The total number of kill for 1960 was: waterfowl, 5,560; deer, 176; and turkey, 8.

Other wildlife interests besides hunting are found in the basin. These range from those who wish to preserve all species and natural areas to those who would reduce or eradicate certain species. There are ten ornithological societies, 25 hunting and fishing clubs, and 120 garden clubs with special interest in wildlife conservation.

IV. WATER AND RELATED LAND RESOURCE PROBLEMS

This chapter discusses the physical problems affecting the water and related land resources of the Chickasaw-Metropolitan Basin. Erosion and sediment are identified as major problems that directly damage land, water, fish, wildlife, recreation potential, and esthetic quality. Floodwater problems occur on all four major streams and most of their tributaries. Causes, effects, and economic consequences of the physical problems are interrelated. For example, erosion causes sedimentation which aggravates flooding, impairs drainage, pollutes surface water, and results in economic losses to both landowners and the public. These natural resource problems can be expected to intensify as population increases, particularly in the western part of the basin.

Erosion and Sediment Damage

Erosion and sedimentation, and the kinds of treatment required for their control, vary widely in different areas of the basin. Three problem areas were recognized and delineated based on degree of erosion, intensity of land use, density of population, kinds of soils, and physical characteristics of the landscape. These problem areas are shown on the map, Figure 4.1.

Problem area 1, in the western portion of the basin, contains the urban areas of Memphis, Millington, Bartlett, Germantown, Collierville, and Southaven. It contains the drainage areas of Nonconnah and Horn Lake Creeks and the lower portions of Wolf and Loosahatchie Rivers. Rapid urbanization distinguishes the needed erosion control measures from other parts of the basin.

Land being held for development or speculation is often left idle or farmed very intensively to maximize returns. Little concern is attached to soil protection or runoff control. About 20,000 acres of this land erodes at an annual rate of 10 to 15 tons soil loss per acre.

The rate of soil loss rises sharply when grading, shaping, and excavation for construction takes place. Soil losses may approach 250 tons per acre annually, creating severe sediment damage and polluting streams. About 3,600 new acres become involved in the development process each year, requiring an average of five years for vegetation to become reestablished.

Erosion and sediment problems are found in established urban areas in parks, poorly kept yards, school grounds, utility rights-of-way, and in areas being razed for new construction. Undeveloped flood plain lands suffer scour damage and damage by deposition of sediment from upstream erosion. Sanitary land fills in the flood plains are subject to disturbance by flooding that could result in pollution of the streams and impairment of the local environment.

Severe erosion following excavation for building development in Memphis.

Sediment from land grading in the urban areas damages stream channels and pollutes surface waters.

4-30376

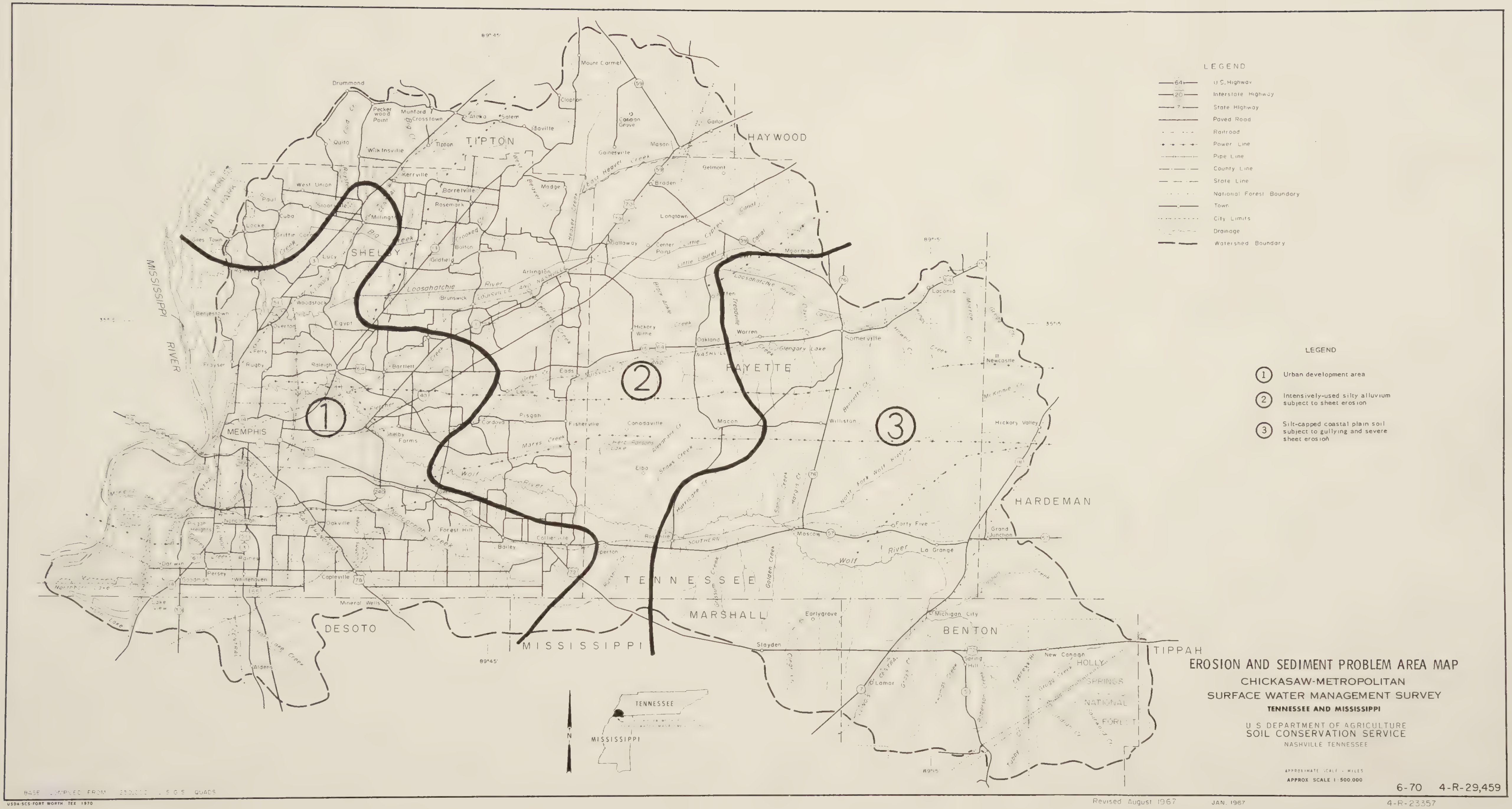

LEGEND
U.S. Highway
Interstate Highway
State Highway
Paved Road
Railroad
Power Line
Pipe Line
County Line
State Line
National Forest Boundary
Town
City Limits
Drainage
Watershed Boundary
LEGEND
1 Urban development area
2 Intensively-used silty alluvium subject to sheet erosion
3 Silt-capped coastal plain soil subject to gullying and severe sheet erosion
TIPTON
HAYWOOD
SHELBY
FAYETTE
HARDEMAN
MEMPHIS
MISSISSIPPI RIVER
TENNESSEE
MARSHALL
BENTON
DESOTO
MISSISSIPPI
TIPPAH
HOLLY SPRINGS NATIONAL FOREST
TENNESSEE
MISSISSIPPI
EROSION AND SEDIMENT PROBLEM AREA MAP
CHICKASAW-METROPOLITAN
SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NASHVILLE TENNESSEE
APPROX SCALE 1:500,000
6-70 4-R-29,459
USDA-SCS-FORT WORTH, TEX 1970
Revised August 1967
JAN. 1967
4-R-23357

Figure 4.1

Problem area 2, in the mid-portion of the basin, is used mostly for large general farming operations. Medium-to-high yields of cotton, corn, and soybeans are produced by continuous row cropping with the use of large mechanized equipment. Severe sheet erosion on sloping cropland is the dominant problem. Due to the deep silty deposits which range from 5 to 30 feet, the damages from soil losses are not as high as they would be on the sandy soils such as are found in the eastern parts of the basin. Sedimentation damages are also less in this area due to the fineness of the silty material, much of which is carried in suspension by surface water instead of depositing in channels and along streambanks.

Problem area 3, in the headwater areas of the Wolf and Loosahatchie Rivers, is drained by a well-developed pattern of draws, is highly dissected, and generally hilly. It is underlaid by sandy coastal plain deposits and is overlaid with brown silty loess material of variable thickness. This soil formation is highly erosive. About 50 to 75 percent of the topsoil has been lost from the upland part of this area. The continuous cultivation of land in row crops, without adequate conservation practices, has contributed to an excessive loss of topsoil and the creation of critically eroding areas including active gullies. Many acres of land subject to severe sheet erosion and gullying have become idle. This is a general agricultural area producing low to moderate yields of cotton, corn, soybeans, hays, and pasture on the upland soils. The bottom land soils are farmed more intensively and are of major importance in crop production where sediment and flooding are not problems. Farms are small, averaging about 150 acres in size. It is estimated that 85 percent of the critical erosion in the basin occurs in this area. Approximately 50,000 acres of highly eroded land, gullies and road banks in this area contribute about 6,700,000 tons of sediment to streams and flood plains each year.

EROSION

About twelve million tons of soil are displaced each year by erosion. This averages about 10 tons of soil movement per acre on the uplands of the basin. The ranges of estimated soil losses for different kinds of land are shown in Table 4.1.

Table 4.1 - Range of annual soil loss by erosion
Chickasaw-Metropolitan Surface Water Management Survey

Kind of land	Range of annual soil loss - ton/acre
Forest	0 to 2
Pasture	3 to 15
Cultivated	3 to 35
Critically-eroding areas	30 to 50
Roadbank	50 to 150
Gully	150 to 210

These rates, except for forests, are excessive when measured against the tolerable annual soil loss of two to five tons per acre. The tolerable soil loss is the estimated maximum soil loss that can be tolerated and yet achieve sustained economic production in the foreseeable future. This takes into account present technology, acceptability of conservation practices, and future population. It assumes a maintenance of soil depth and tilth favorable for crop and timber production and that soil loss will not be great enough to diminish productivity of the soil over a long period of time. It also assumes that soil losses will not cause significant sedimentation damages.

The basin has a high rainfall-erosion index, ranging between 300 and 320. This is a measure of the potential of rainfall to erode soil in a given locality. The high rainfall-erosion potential combined with frequent cultivation of the highly erosive soils has resulted in severely eroded soils on a large part of the area. The resulting sediment from the eroded uplands clogs stream channels and causes significant acreage of bottom land to become water-logged and less productive.

Sheet Erosion - Table 4.2 shows estimated acres of sheet erosion by land use in each of the four major drainage areas of the Chickasaw Basin.

Sheet erosion accounts for the movement of 3,471,400 tons of soil per year in the basin. Of this amount, approximately 75 percent or 2,600,000 tons are eroded in problem area 2 of the basin. The high amount of sheet erosion is reflected by the fact that only 16,700 acres or 8 percent of the Classes II, III, and IV cropland has adequate conservation treatment according to the 1966 Conservation Needs Inventory. Only 6,320 acres or 19 percent of the pasture is adequately treated. About one-fourth, or 124,600 acres, of the area suffering from sheet erosion has advanced to a stage of severe erosion.

Table 4.2 - Sheet erosion by land use and drainage areas (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Drainage areas	Cropland	Pasture land	Forest land	Total
Nonconnah-Horn Lake				
Slight to moderate	17,300	14,800	14,900	47,000
Severe	18,250	8,900	-	27,150
Loosahatchie				
Slight to moderate	78,700	26,600	48,150	153,450
Severe	30,500	11,700	-	42,200
Wolf River				
Slight to moderate	52,650	27,650	103,650	183,950
Severe	31,550	23,700	-	55,250
Sub-total				
Slight to moderate	148,650	69,050	166,700	384,400
Severe	80,300	44,300	-	124,600
Total	228,950	113,350	166,700	509,000

4-30376

Severe erosion just after cotton was planted on Memphis silt loam.

Spectacular erosion occurs in the headwaters of the basin where coastal plain sands are overlaid with loess materials.

4-30376

Critical Erosion - Critical erosion, an advanced stage of severe sheet erosion, but not yet in the gully stage, occurs on 44,090 acres, of which 26,400 acres are in problem area 2. About 1,938,000 tons of soil movement occurs each year on these areas. Problem area 2 accounts for 1,163,000 tons of this erosion.

Table 4.3-Critical erosion by land use and drainage area (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Drainage area	Cropland	Pasture land	Forest land	Other	Total
Nonconnah-Horn Lake	1,050	650	370	370	2,440
Loosahatchie	5,450	1,850	2,000	4,000	13,300
Wolf	9,400	5,850	9,500	3,600	28,350
Total	15,900	8,350	11,870	7,970	44,090

Gully Erosion - Gullies represent the most severe type of erosion found in the Chickasaw-Metropolitan Basin. Gullies are a serious problem on 13,310 acres with 10,640 acres occurring in problem area 3. It is estimated that gullies produce from 150 to 210 tons of soil loss per acre per year and that 2,395,800 tons of soil are being displaced within the basin annually. The land damaged by gullies is almost totally non-productive and there is a decrease in efficiency of farm operations due to gullies. There is also a marked difference in monetary value of land that is severely damaged by gully erosion.

Table 4.4 - Gully erosion by land use and drainage area (acres)
Chickasaw-Metropolitan Surface Water Management Survey

Drainage area	Cropland	Pasture land	Forest land	Other	Total
Nonconnah-Horn Lake	130	80	50	50	310
Loosahatchie River	2,900	1,000	1,050	2,150	7,100
Wolf River	1,950	1,250	1,900	800	5,900
Total	4,980	2,330	3,000	3,000	13,310

Roadbank Erosion - It is estimated that 1,375 acres of roadbanks have a severe erosion problem. Roadbank erosion occurs in the same way as gully erosion, usually cutting deep into subsoil material. Most roadside erosion occurs on county roads in the basin. An estimated 138,900 tons of soil are eroded from roadbanks each year, filling roadside ditches and spewing alluvial fans of infertile soil across bottom lands. The combined Nonconnah-Horn Lake drainage areas have approximately 100 acres of raw eroding roadbanks. Loosahatchie River has 420 acres and Wolf River has 855 acres of such eroding areas.

Of the agricultural lands of the basin including forest, 183,375 acres, or 32 percent, have been seriously damaged by accelerated erosion. This is made up of 124,600 acres of severe sheet erosion; 44,090 acres of critical erosion; 13,310 acres of gullies, and 1,375 acres of eroding roadbanks.

Thus, it can be seen in figure 4.2 that 79 percent of the erosion on agricultural lands has occurred on only 32 percent of the basin area.

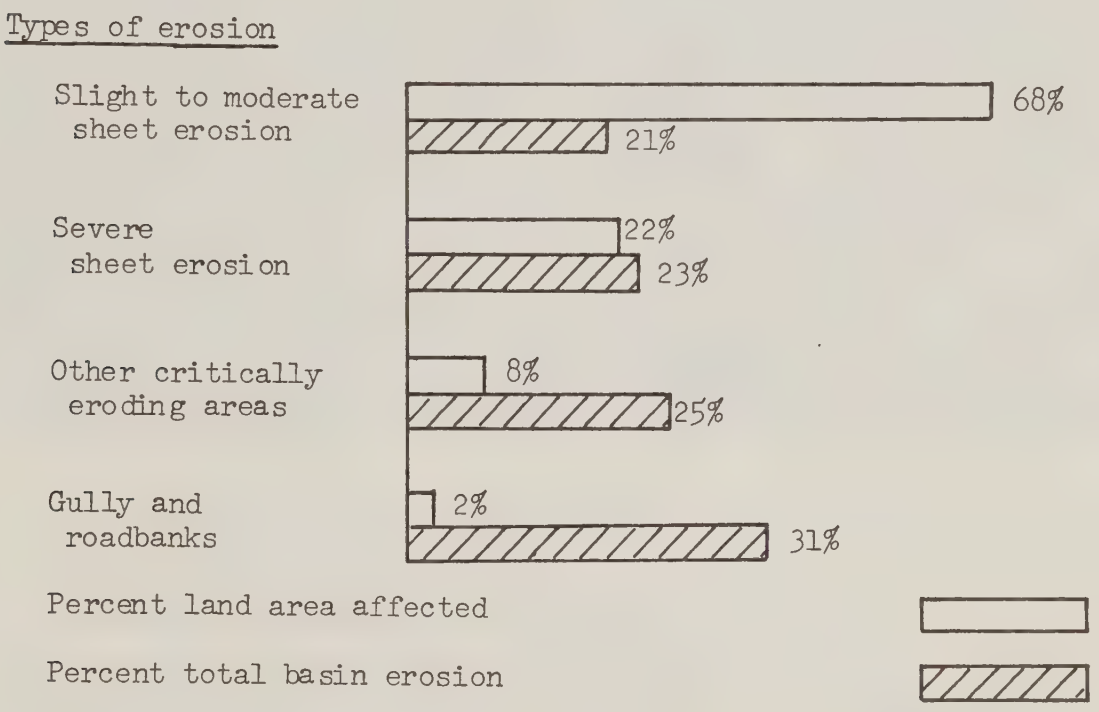


Figure 4.2 - Percent of erosion by types on agricultural lands of the basin
Chickasaw-Metropolitan Surface Water Management Survey

Streambank Erosion - Streambank erosion in the Chickasaw Basin differs greatly between streams. The total amount of sediment contributed is small when compared to other types of erosion. Caving and cutting occurs below bridges and sharp bends on most streams. Stability of the sandy-silty materials along most of the streams is poor.

Loosahatchie River has the most stable streambanks, although the upper reaches and tributaries have some problems of undercutting and degrading. The favorable stability found in the lower and middle reaches is primarily due to low gradient which helps to maintain low velocities. In addition, there is a growth of vegetative cover composed of large trees, brush, honeysuckle, and other native plants.

4-30376

The lower reach of Wolf River channel below Germantown, Tennessee, was excavated in the early 1960's. Since this construction, channel widths have doubled in size due to bank erosion. This erosion is still occurring.

In the reach of Wolf River between Rossville and Moscow, Tennessee, extensive sand deposits are evident in the main channel. The sand blocks or "plugs" were deposited by tributaries from both the north and south sides of the valley. Intermingled in these sand deposits are fallen trees and logs. The river channel is unstable since it passes through brown loam and coastal plain deposits which are very erodible. Any straightening of the stream channel in this reach would cause large quantities of sand and silt to be transported in the lower reaches, and most tributary channels would experience degradation. The cost of maintenance to the improved section of Wolf River channel would be high.

Nonconnah Creek has caving and sloughing of streambanks due to unstable soil materials, urban development that increases peak discharges, high rates of direct runoff, and widespread excavations and filling of the valley floor. The size and location of the creek channels have been changed many times in the past 20 years due to construction and the mining of sand and fill materials. The channel has a steep gradient that aids in producing high velocities. The cross-sectional shape is quite irregular. All these conditions contribute to the problems of channel stability and the high cost of maintenance.

The channel of Horn Lake Creek is temporarily stable due to vegetation, meanders, and restrictions, such as levees at Robco and Tomco Lakes and bridges. Due to soil types and stream gradient, a disturbance in the stabilized conditions would cause sloughing and degrading of the channel.

Forest Erosion Problems - The erosion problems of forest lands differ in the three problem areas of the Chickasaw-Metropolitan Basin. The upland forest of the headwaters coastal plain area has highly erosive soils already badly eroded. Originally these sandy soils had a mantle of loess on which upland hardwoods grew well. Much of this was cleared and farmed and accelerated erosion exposed the sands. Gullies formed, and the land was allowed to return to forest cover. Many gullies remain. Most of these soils have not regained their original productivity.

In the mid-portion of the basin, soils are the deep loess of the Mississippi Valley Silty Uplands. Forests are smaller in acreage, scattered, and usually located where drainage or accessibility has precluded clearing for cropland. Although the loess soil is highly erosive, the effects of erosion are not as pronounced. Where forest cover is provided, erosive conditions are healed quickly. These forests can generally have a high erosive potential, but a relatively low existing erosion problem. Productivity losses due to erosion are slight.

Severe erosion leaves little choice for producing species other than pine. This area can no longer be used for pasture.

In problem area 1, where the brown loam bluffs are being urbanized, forests must be considered dormant homesites awaiting construction activity. Some, hopefully, will become parks. For the most part, erosion from such forested lands is negligible.

Forest erosion problems are centered in the upstream coastal plains. The erosion problems are aggravated by uses or abuses of the protective cover caused from farm or logging activity. Fires and livestock are found to create the greatest amount of damage to the protective forest cover. The upper surface of organic matter on the soil is disturbed exposing the mineral soil to surface erosion. An estimated 600 acres of basin forest are damaged each year by fire and estimated 50,000 acres or 17 percent of the forest area are exposed to damage by livestock grazing.

Other factors creating erosion problems include poor logging practices where soils are disturbed through log skidding and haul road construction. About 70,000 acres are estimated to be exposed to logging activity each year. This is slightly over 20 percent of the total forest area.

Critical erosion in forested areas is in the form of gullies and unimproved road ditchbanks. The roadbanks are discussed elsewhere. Gullies, while frequently found in forested areas, are usually due to concentration of

water from cleared lands or rights-of-way in areas where sufficient soil protection is not provided. In no cases studied did a gully form within forest under forest use. They crept in from adjacent roads or fields or formed when the land was cleared for pasture or crops. It could be expected that improperly located logging roads could create gullies, but none were found. Critical areas in the forest amount to 3,000 acres.

SEDIMENT

Sediment has damaged 34,000 acres of crops and pasture lands located in the tributary flood plains of the basin, reducing their original productive capacity by 45 percent. Much of the remaining bottom lands of the tributaries have received sediment damages to a lesser extent.

Sediment damages occur primarily from the products of accelerated or advanced erosion carried by water and deposited on the bottom lands by overbank flow of floodwater. The amount of sediment that is deposited at any given point downstream depends on the watershed features, distance moved, weight, size, and kinds of soil materials, and types and frequencies of flooding.

Sediment yield in the Chickasaw-Metropolitan Basin averages about 4,000 tons annually per square mile, but there is wide variation between tributaries. It is estimated that annual sediment totals about 8,000,000 tons with an estimated 467,000 tons being delivered to the Mississippi River each year.

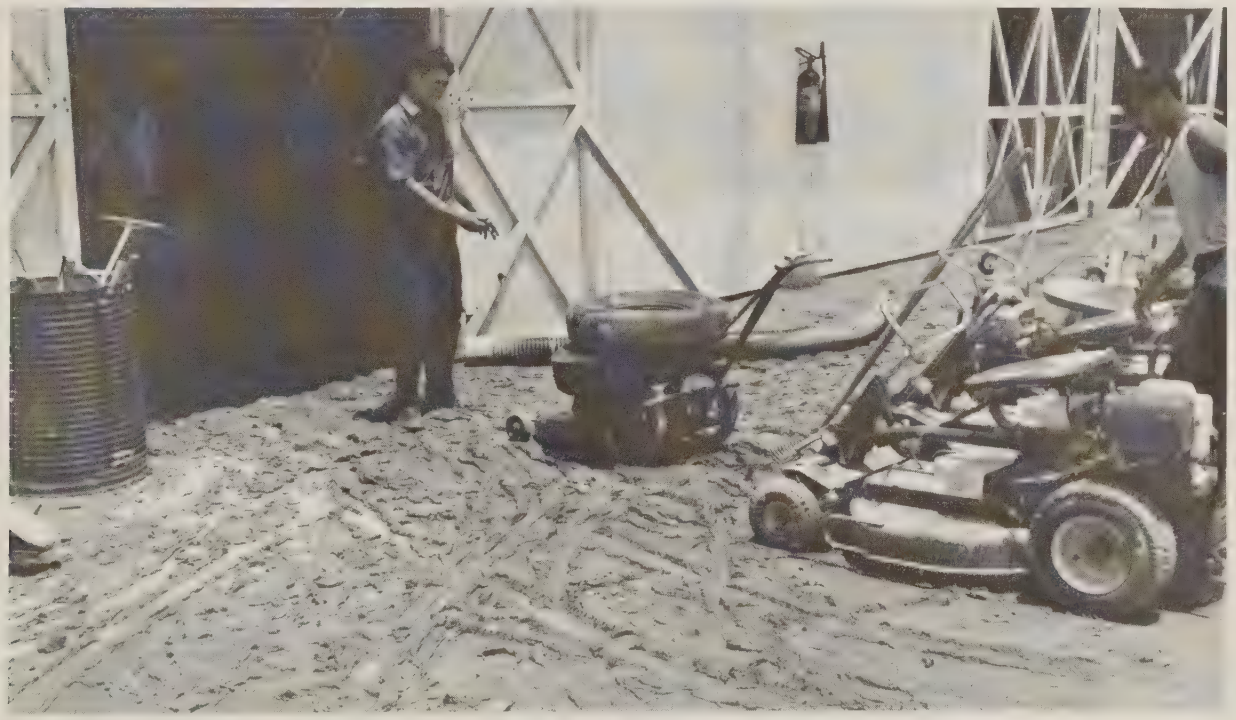
Table 4.5 summarizes estimated annual soil movement and amounts of sediment delivered to the Mississippi River.

Table 4.5 - Estimated annual soil movement and sediment delivered to the Mississippi River by major streams
Chickasaw-Metropolitan Surface Water Management Survey

Kinds of erosion	Total area (acres)	Soil movement			
		Nonconnah-Horn Lake (tons)	Loosahatchie (tons)	Wolf (tons)	Total (tons)
Slight to moderate sheet erosion	384,400	193,300	743,400	683,500	1,620,200
Severe sheet	124,600	409,500	668,900	772,800	1,851,200
Critical area	44,090	85,400	464,300	1,388,900	1,938,600
Gullying	13,310	55,800	1,278,000	1,062,000	2,395,800
Roadbanks	1,375	10,100	42,420	86,355	138,875
Total erosion	567,775	754,100	3,197,020	3,993,555	7,944,675
Delivery rate factor		0.10	0.06	0.05	
Delivered to Mississippi River		75,400	191,800	199,700	466,900

4-30376

The Loosahatchie River delivers a heavy burden of sediment from eroding loess uplands to the Mississippi River.



Sediment dropped by the flood of June 15, 1970, at maintenance shed of U. S. Naval Air Station at Millington.

4-30376

Filling of the channel on Wolf River demonstrates the futility of channel improvement without land treatment and dams to control sediment.

Bank-full deposits of sand on McKinney Creek, a tributary of Wolf River, has almost totally destroyed its effectiveness to carry floodwaters.

4-30376

Based on the above table 4.5, it is apparent that 80 percent of the total sediment yield of the basin comes from the same 32 percent of the basin land area that produces 79 percent of the total erosion.

Damages in the form of increased swamping of the flood plain due to deposition of sediment in channels and by deposition from overbank flow occurs in many watersheds. Reduced crop yields and in some cases complete loss of productive soils have been observed. Most of these damages from sedimentation occur in watersheds in the Southern Coastal Plains land resource area. Sediment damages are severe in the Wolf and Loosahatchie River flood plains and many of their tributaries in this land resource area. This is due in part to the larger sand particles displaced by erosion from the subsoils of this area. Suspended sediment in the water from silt deposits causes a degradation of water quality.

An estimated $345,450 in damages from sediment and swamping occurs annually on 27,200 acres of Chickasaw-Metropolitan Basin flood plain lands. These damages are primarily from reduction in production. In addition to loss of crop production, sediment clogs streams, fills lakes, lowers water quality, changes course of stream flow, robs the land of plant nutrients, and transports pollutants.

Here in the Wolf River at Moscow, Tennessee, a bottom-land hardwood site has become swamp due to sedimentation.

4-30376

Sediment problems occur in forested flood plains to a considerable extent in the upstream part of the Wolf River Subbasin. In this area, coarse sediments are dropped as stream flow from tributary watersheds slows and loses its capacity to carry the sands and silt. Above Michigan City, Mississippi, the forested flood plain is changing its tree composition due to sediment deposition.

The acreage of forest damaged by sediment is not available. An estimated 1,200 acres of forest in this area has already become too swampy to support the more valuable bottom-land hardwoods. Downstream from Rossville, Tennessee, sediment deposits have not created such an impact on the forest. Here, sediment deposition in forests has been more in the form of silt, over longer time periods, and creates less swamping. In the lower Loosahatchie and Wolf Rivers where the Mississippi River has an influence, swamping has occurred. This area, however, is becoming industrial and damages to existing forest are cancelled by such major changes in land use.

Floodwater Damages

Most of the tributary streams and portions of the four principal streams in the basin flood quite frequently. Flood damages on the Wolf and Loosahatchie Rivers are mainly agricultural, while damages on Nonconnah and Horn Lake Creeks are primarily urban.

Flooding along the Loosahatchie River occurs mostly during the winter and spring months. For the 20-year period 1939 through 1958, stream gage records at Brunswick, Tennessee, show out-of-bank flow occurred sixty-one times. Forty-eight of these floods occurred during the winter months and thirteen occurred during the cropping season of April through November. Nine of the thirteen floods during crop season occurred in April and November, with the remaining four occurring in the months of May through September.

Flooding occurs in the lower half of the Loosahatchie more frequently than in the upper half. The channel gradient in the lower reaches is gentle. Large trees grow in the channel bottom and on the side slopes. There is aggradation of the channel bottom in the lower reaches and degradation in the upper reaches of the watershed. The maximum recorded flood occurred in January 1935, and inundated approximately 26,300 acres of flood plain land. The annual flood inundates approximately 14,700 acres. Tributary floods are likely to occur during any month of the year but are more common during the winter and spring months.

Backwater from the Mississippi River flood of 1937 inundated the flood plain of the Loosahatchie River in the lower reach, extending three miles upstream in the channel from the stream gage located near Brunswick, Tennessee.

Big Creek, a tributary of Loosahatchie River, has minor urban flood problems. Large floods inundate portions of the city of Millington and parts

Floodwater from Big Creek destroyed 40 acres of cotton and soybeans on June 15, 1970.

Traffic was blocked on the road between Brunswick and Bolton by flooding of the Loosahatchie River on June 15, 1970.

4-30376

Floods often bring misery and suffering to those least able to bear it. Flooding of North Fork Creek in Millington damaged the homes of twenty families in June 1970.

This farm dwelling was marooned by the flooding of the Loosahatchie River in April 1968.

4-30376

of the U. S. Naval Air Station, and are a major deterrent to the orderly expansion of the city of Millington.

Improvements to the Wolf River channel from its outlet at the Mississippi River to Grays Creek in Shelby County have reduced the frequency of flooding to approximately once in five years and provided adequate outlets for tributaries within this reach.

Flooding occurs much more frequently above Grays Creek where no channel improvements have been made. Much of the main stream and many of the tributaries are completely filled with sand and silt deposits so that new meanders of the channel occur during floods. Flooding on the main stream usually lasts for several days and is more frequent during the winter months. Isolated areas of flooding occur along the main stream of Wolf River after each storm that produces measurable runoff. Flooding on the tributaries is usually much shorter in duration and can be expected to occur during any month of the year. The 100-year flood inundates approximately 48,000 acres within the watershed. About 15,500 acres can be expected to be inundated on the average of once a year.

Historical information concerning flooding on Nonconnah Creek is scarce. Flood profiles were obtained for approximately seven floods dating back to January 1935. The largest flood occurred May 9, 1958, after 4.76 inches of rain fell in approximately ten hours. Flooding occurred mostly in the upper two-thirds of the watershed and damaged crops and pasture, roads, homes, and business establishments. Prior to 1958, most of the flood plain was either idle or agriculture areas. Present floodwater damages are mostly urban, with minor agricultural damages in the headwaters. Investigations of this watershed revealed that approximately 800 residences would be affected by the 100-year flood. Encroachment on the flood plain is still continuing with the eminent flood threat to property and human life.

Flooding of the bottom lands of Horn Lake Creek Watershed is widespread and occurs frequently. Some portions of the flood plain are inundated several times a year. It is estimated that approximately 30 percent of the total flood plain area is inundated on the average of at least once a year.

Within Shelby County, the demand for land near business centers has resulted in many developments within flood-prone areas. The efficiency of location, including access to business centers, sanitation and utility facilities, and the lower cost of flood plain land is a motivating factor to developers.

The flood plains of Horn Lake Creek, Nonconnah Creek, Wolf River and Loosahatchie River all are readily accessible to the business centers of Memphis. Development is taking place at a rapid rate in the Nonconnah Creek flood plain. A land use plan developed for DeSoto County, Mississippi, in December 1968, indicates that developments will encroach into

the Horn Lake Creek flood plain in the near future. It is reasonable to assume that this trend will continue into the Wolf and Loosahatchie flood plains. As more development covers the watershed, replacing areas of grass, scrub timber, and brush with rooftops, driveways, parking lots, and other impervious areas, the hydrology of the flood plain will change. This change compounds the problem of flooding by accelerating the rate of runoff.

At present, the only management principal applied to flood plain development is the requirement to place curb and gutter elevations one and one-half feet above the 100-year flood elevation. This requirement is met with earth fills that increase the potential flood hazard by obstructing the normal flow of water through the flood plain. The consequences of this policy are depicted in Figure 4.3.

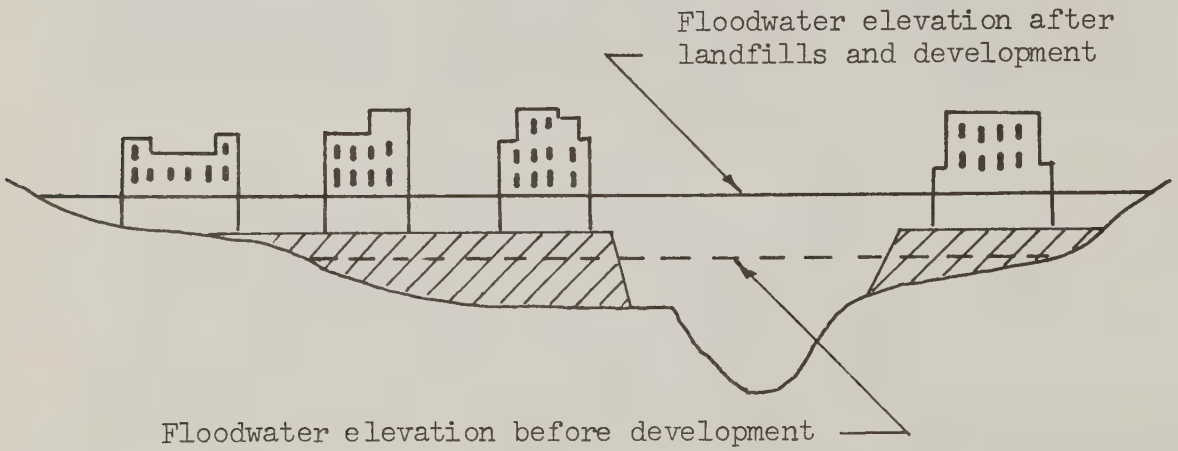


Figure 4.3 - Effect of unsound flood plain development in raising the depth of flooding
Chickasaw-Metropolitan Surface Water Management Survey

Horn Lake Creek is quite similar to Nonconnah Creek, with the primary difference that Horn Lake Creek has not been developed to the extent of Nonconnah. The uplands of Horn Lake Creek Watershed are presently being developed at a rapid rate and it will only be a few years before the flood plain, as well as the upland, will be in residential, commercial, or industrial uses.

Table 4.6 shows the estimated average annual flood damages within the four drainage systems that compose the Chickasaw-Metropolitan Basin.

The 1958 flood on Nonconnah Creek looking east from Lamar. Note homes in subdivision affected by this flood.

Henry Loeb, now Mayor of Memphis, inspects results of the May 1958 flood on Nonconnah Creek.

4-30376

Fill on Tennessee State Highway 57 west of Moscow washed out by flooding of Golden Creek in July 1967. The night after repairs were completed at the taxpayers expense, the damage was repeated by a second storm.

Flooding of the Wolf River in 1967 caused severe damage to this cotton in a field near Rossville, Tennessee.

4-30376

Table 4.6 - Estimated average annual flood damages by major drainage systems
Chickasaw-Metropolitan Surface Water Management Survey

Major drainage system	Flood plain acres 2/	Dollar damage 1/							
		Crop and pasture damage 4/	Road and bridge damage	Other agricultural damage	Sediment damage	Swamping damage	Other property damage	Indirect damage	Total damage
Wolf River	48,100	250,050	16,700	27,900	214,950	13,200	2,000	33,350	558,150
Nonconnah Creek	15,000	-	17,800	-	-	-	304,500	51,100	373,400
Horn Lake Creek	3,170	10,600	12,100	-	2,700	-	242,300	40,400	308,100
Loosahatchie River	61,750	446,300	28,600	28,350	156,650	3,100	13,300	53,500	729,800
Total 3/	128,020	706,950	75,200	56,250	374,300	16,300	562,100	178,350	1,969,450

1/ Price base: adjusted normalized. 2/ Based on 100-year flood.

3/ Does not include that area within operational PL-566 watershed projects.

4/ Damage to forest not included.

Impaired Drainage

Drainage problems vary widely throughout the four subbasins. The major streams of the basin provide good outlets for surface drainage in some areas, and in other areas the main streams are so choked with sediment and tree growth that overbank flow is common. The clogged channels do not provide proper outlets for drainage of surface waters from the tributaries. Frequent overbank flows and sediment deposition have resulted in a swamping condition of many acres of fertile bottom land.

Nonconnah Creek, a rapidly-urbanizing watershed, has channels capable of providing adequate drainage for the area under most conditions. During periods of extreme rainfall intensity, storm drains often stop up and cause flooding of yards and streets. Most areas that are in agriculture are adequately drained.

The Shelby County portion of Wolf River was dredged in the early 1960's and provides a good outlet for the tributaries. Above the point where channel improvement was terminated, channel capacities are generally inadequate to prevent frequent overflow of storm runoff. Deposition of sediment and tree growth in the Wolf River and tributary channels has reduced the carrying capacity and created swampy conditions in parts of the bottom land in the upper portions of the Wolf River. The Loosahatchie River provides good outlets for farm drainage. During periods of heavy rainfall, however, surface drainage is impaired by high water in the main stream. Stream channel overflow occurs more frequently in the lower one-half of the watershed.

The bottom land adjacent to Horn Lake Creek floods frequently. Drainage of these areas is difficult because of the poor outlet conditions that exist on the main stream.

The most significant drainage problems are encountered on the Falaya-Waverly-Collins soil association, which occupies alluvial plains of the basin. The Waverly soils are the wettest of the three, but will grow corn and soybeans if drainage practices are applied. Most of the Waverly soil areas are in woodland. Approximately 48,100 acres of land are poorly-drained uplands soils.

Approximately 336,800 acres of agricultural land in the basin has some kind of water problem. Most of this land is located in the bottoms adjacent to stream channels. Agricultural land with water problems is shown in Table 4.7.

These water problems consist of both flooding and impaired drainage and are often inseparable. While few bottom-land soils have internal characteristics that cause severe drainage problems and limitations, many have slight or moderate drainage problems. Surface drainage is also a problem even in areas not affected by flooding.

Table 4.7 - Agricultural land with water problems 1/
Chickasaw-Metropolitan Surface Water Management Survey

Land class W-subclass	Cropland (acres)	Pastureland (acres)	Forestland (acres)	Other (acres)
IIw	87,700	25,600	44,400	5,600
IIIw	60,200	12,900	59,300	2,000
IVw	23,700	4,500	4,300	1,200
VIIw	0	0	5,400	0
Total	171,600	43,000	113,400	8,800

1/ Conservation Needs Inventory

Water Shortages

The average annual rainfall is sufficient for most crops grown in the basin. However, during the cropping season the intervals between rainfalls are often several weeks in duration, creating a temporary shortage of soil moisture. The months of July, August, and September represent the critical soil moisture period for crops grown in the basin. In these months, evapotranspiration generally exceeds precipitation and results in a progressive drying of soil during the remaining part of the growing season. Soil moisture is generally sufficient during the spring and early summer, but occasional droughts do occur. A few growers of high quality vegetables are equipped for irrigation during drought periods. The source of irrigation water is usually wells. Soil moisture in the fall is sometimes insufficient for obtaining good stands of winter cover crops.

There are no serious shortages of water for livestock and rural domestic purposes in the basin. The source of water for livestock is generally farm ponds and only during an extended drought period is the water supply limited. Wells are the normal source of water for rural domestic use and few cases of water shortages occur. These are generally caused by faulty pumping equipment or wells that are too shallow. There is no shortage of groundwater supply for municipal and industrial use.

The crop seasonal rainfall in West Tennessee is often distributed very poorly. High seasonal or high monthly rainfalls are not indicators of drought days. A drought day is one in which the plant-available moisture in the soil has been exhausted. Factual studies show there is little correlation between annual rainfall, or even monthly rainfall, and drought days. The probability of encountering a certain number of drought days for a soil plant combination are shown in Table 4.8.

Table 4.8 - Probabilities of drought at a three-inch soil moisture base at Brownsville, Tennessee 1/

Minimum number of days	July	August	September
	Percent probability		
2	92	84	76
5	76	76	60
10	60	60	48
15	56	52	44
20	32	40	24
25	12	24	8

1/ From "Tennessee's Water Resources" - April 1961

Some of these droughts come as the crops go into the fruit-bearing stage. This is at a growth stage when the plant consumptive use is at a peak and requires much more moisture than other stages of growth. Lack of adequate moisture at this time can seriously affect the crop yield even if other levels of management are sound.

Pollution

Surface waters of the basin are polluted by commercial and industrial wastewater, municipal sewage, and agricultural pollutants. The presence of one or more of these pollutants in sufficient quantities results in a poor quality of surface water undesirable for any purpose without extensive treatment. The abundance of high quality ground water, and the relatively low cost of pumping and treating it, has overshadowed the need for conserving the quality of surface waters in the basin.

The upper reaches of the four main streams in the basin are relatively free of municipal and industrial pollutants. In these areas, sediment is the predominant pollutant. In many tributaries the stream channel capacities have been reduced by sediment deposition. Sediment is constantly being transported from the higher elevations to the lower flood plains. Fine particles of loess materials stay in suspension for many days and are responsible for the high turbidity of surface water.

Many areas are being used for the purpose of illegal refuse dumping. The most convenient areas are found in roadside drainageways and in streams at bridge crossings. This practice contributes to stream pollution and the general uncleanliness of the surface water.

Pollution in the lower reaches of the four main streams and their tributaries is a very serious problem, particularly in Shelby County. The discharge of commercial and industrial wastewater into these streams and lakes, along with accidental spillage of raw sewage, has brought about

Pressure for urban development results in encroachment on the flood prone lands along Nonconnah Creek.

Houses and the fills on which they are built aggravate flood hazards by restricting the natural capacity of the flood plains.

4-30376

The bridge opening for Wolf River at Highway 70 has been partly closed by land filling operations.

Increased storm runoff due to urbanization has seriously damaged the John's Creek channel in Noncornah Creek Watershed.

4-30376

marked changes in the biological, physical, and chemical characteristics of these surface waters. Discharges of wastewater have brought on problems of thermal pollution, reduced oxygen levels, increased demand on the assimilative capacity of the receiving waters, and in some areas, a serious health hazard.

Nonconnah Creek is relatively free of noticeable amounts of pollution from Mt. Moriah Road upstream to its headwaters. Pollution rapidly increases from Mt. Moriah Road to the confluence of McKellar Lake, a slack water harbor of the Mississippi River. McKellar Lake takes the full brunt of Nonconnah Creek and other significant industrial pollution. The pollution of this creek is more intense than other major streams of the basin because of its low normal flow. Wastewater from numerous sand and gravel operations creates a terrific turbidity problem in Nonconnah Creek and some of its major tributaries. Many industries also discharge wastewater containing dyes, acids, bleaches, solvents, alcohols, and other materials. The most serious pollution problem existing in Nonconnah Creek is domestic sewage that enters the creek from leaking overloaded municipal sewer lines.

Wolf River suffers from severe industrial and municipal pollution in the Memphis area. There is no significant pollution above Memphis except from sediment. In the lower portion pollution is extensive, caused by industrial and municipal pollutants. Between January and February 1968, the pH was 6.2 and 6.7; the D.O. was 8 ppm and 9 ppm; hardness 34.2 ppm; and M.O. alkalinity was 8.0 ppm. The normal color of the stream is turbid to slightly turbid. Numerous sand and gravel operations make the water of Wolf River highly undesirable.

The Loosahatchie River receives wastewater from fewer industries than the other major streams, but its major tributary, Big Creek, receives the effluent from several municipal sewage treatment plants. The Loosahatchie River is now comparatively free of pollution, but with the rapid expansion of commercial and industrial development in the surrounding Memphis area, the pollution threat will be increased.

Horn Lake Creek is relatively free of municipal and industrial pollution. The major pollutant in this stream is sediment. Stream channels are inadequate because of the deposition of sediment. Although the drainage area of Horn Lake Creek is predominantly agricultural, it is expected to urbanize rapidly. Unless steps are taken to prevent pollution during the urban development, this stream is also threatened with commercial and industrial pollution.

Problems Affecting Fish and Wildlife Resources

Fishery resources are most notably affected by sediment and municipal and industrial pollutants in the lower reaches of the four major streams of the basin. Frequent flooding of most of the streams in the basin and stream channel improvements along some streams add to the problems of fish

production. Wildlife does not appear to be affected by the pollution in the Chickasaw Basin although the effects of agricultural pesticides on wildlife is unknown.

Streamflow in the major tributaries of the Wolf River, such as Shaws Creek, Fletcher Creek, Grays Creek and McKinnie Creek, is intermittent with water in pools only. In the summer months, tributary flow is limited to short periods following high intensity rain storms and normal water color is turbid. Although some fishing may exist in pools in the lower reaches, most fishing opportunities are classified as extremely poor.

North Fork of the Wolf River near Moscow, Tennessee, has a continuous spring-fed flow. The stream is also subjected to heavy and frequent flooding. Velocity is sluggish and there is a moderate agricultural pollution problem. Normal color is slightly turbid. Availability of fish food organisms and fertility level of the stream is average. Shade or canopy is good over the entire length of stream. Fishing pressure is light as accessibility is a problem with only two major roads crossing the stream.

The Nonconnah Creek Watershed makes up about one-third of Shelby County. Severe industrial and municipal pollution is present in the lower reaches. There is no fishing at present and the potential is limited by both pollution and low flow, with the stream dry over half the time. McKellar Lake, at the mouth of Nonconnah Creek, received substantial amounts of raw sewage and industrial wastes from accidental spillage in the creek, resulting in many severe fish kills within the lake.

The Loosahatchie River is subject to heavy flooding. The greater part of the watershed is used for agriculture and sediment pollution is evidenced by the normal water color being turbid. Fair fishing exists with the main species consisting of Kentucky bass, channel catfish, suckers, and sunfish. Channelization limits the fishing qualities on the lower reaches.

In summary, fishing resources in the four independent streams of the basin is rated poor. This is due mainly to industrial and municipal pollutants and suspended silt. Unstable stream channel bottoms due to shifting sand restricts fish reproduction and production of fish food organisms.

The principal habitat problems affecting wildlife resources are extensive land use changes resulting in less cover each year, and changes in farming practices dictated by economic pressures and the ever-increasing urbanization in Shelby County. The shift of cropland to pasture in the uplands and the increase in size of upland cropland fields eliminates fencerows, old field boundaries and odd areas used as habitat by quail and rabbit. The clearing of bottom-land timber to make cropland and pasture destroys wildlife habitat. Sediment deposited on flood plains also adversely affects the wildlife habitat.

Other problems in the basin that affect the production and utilization of the fish and wildlife resources are:

1. Poor accessibility to fishing waters and hunting areas.
2. Posting of private lands to restrict harvest by hunters and fishermen.
3. The lack of interest by individual sportsmen and sportsman groups in working with private landowners to make economic use of land and water resources for fish and wildlife production and harvest.
4. Inadequate control of poaching and unrestrained predation by stray cats and free-roaming dogs.
5. Inadequate management and harvesting practices that could increase wildlife numbers.

Other Environmental Quality Problems

Air pollution is a significant environmental quality problem within the metropolitan area of the basin. Major sources of air pollution are automotive vehicles and industry. A smelter located in northern Shelby County contributes 12 tons of pollutants to the air each day. As the population of Memphis and Shelby County increases and the number of industries and motor vehicles increase, so will the air pollution problems.

Within the rural areas of the basin, clandestine dumping of garbage and trash is seen along roadways and at bridges. These areas detract from the natural beauty of the area and contribute to pollution problems. Few rural communities in the basin have sanitary garbage disposal systems. Garbage is often dumped in gullies and as erosion occurs, garbage is washed into the streams, reducing water quality. Garbage disposal, within urban areas, also creates eye-sores and greatly detract from the beauty of the area.

Water quality of the Chickasaw Basin is affected by industrial and municipal waste which destroys its desirability for recreational uses, and in some areas has killed all of the fish in the streams. Pollution in the form of suspended sediment colors the water and makes it less desirable for recreational use. During periods of high rainfall the rivers and streams become laden with mud with the color changing to a dark brown. During periods of little or no rainfall many streams cease to flow, leaving potholes of stagnant water.

During construction of subdivisions, shopping centers, and most other types of construction associated with urban expansion, the soil is stripped bare leaving mountains of dirt that greatly detract from the scenic qualities of the area. During periods of rainfall these exposed soils erode severely, and the soil washes into streams and onto roads. This form of erosion increases the amount of sediment pollution and occasionally even fills streams with silt and blocks roads until it can be cleared.

A low-grade agricultural economy in parts of the basin is reflected in unsightly and unkempt farmsteads. Idle land, abused woodlands and weedy pastures associated with marginal and poorly managed farms, have adverse effects on the esthetic beauty.

Flooding deface the valleys by scouring secondary channels into the valley floors and damaging or killing vegetation. Floodwaters deposit an immense amount of unsightly debris on the flood plain.

V. PRESENT AND FUTURE NEEDS FOR WATER AND RELATED LAND RESOURCE DEVELOPMENT

This section describes the need for development to help accomplish the objectives of the study. These needs include developments designed to (1) improve standards of living, economic opportunities, and personal well-being of the people in the basin, (2) provide land treatment for protection and maintenance of the land resource and for control of critical sediment-producing areas, (3) provide flood control and flood plain management along the streams, (4) improve recreational opportunities, fish and wildlife habitat, quality of water, and timber production, (5) improve the quality of the environment, and (6) improve economic efficiency by developments in flood protection and land treatment to lower production costs.

Needs for Development to Meet Food and Fiber Requirements

The Chickasaw-Metropolitan Basin is capable of producing its share of the nation's food and non-wood fiber needs in the future. Production of these commodities is expected to be accomplished on a declining cropland base. It will require the application of improved management and new technologies which are expected to approximately double yields in the next 50 years.

Available pasture technology has not been applied as rapidly as possible because existing pasture acreage has been more than adequate to provide the feed unit needs for the livestock industry. Substantial increases in livestock numbers are projected for the future, but better utilization of existing acreage is expected to provide adequate roughage on a slightly reduced acreage in the future.

Indications are that the basin can meet 1980 demands for veneer, sawtimber, cordwood and other wood products on existing woodland acreage. Meeting expected demands after this time will require improved management including processing the timber for its highest product group. Regardless of the woodland management decision, more acreage is expected to be devoted to woodland in the future if increased pulpwood demands are to be met.

There is an economic need at the national and local level for development which would reduce the cost of producing food and fiber in the basin. Some types of development which could accomplish this are flood protection, drainage, irrigation, and land treatment.

Land Treatment, Conservation, and Use

Application and maintenance of land treatment measures in combination with adjustments in land use are needed for the sound conservation, utilization, and development of water and related land resources of the Chickasaw Basin. This includes application of adapted soil conservation practices on individual farms, the treatment of critically eroding areas, improved

timber management, and the conservation treatment of urban and publicly owned land. The estimated treatment needs of the agricultural land of the basin are shown by land uses in Table 5.1.

Table 5.1 - Land treatment needs for agricultural lands
Chickasaw-Metropolitan Surface Water Management Survey

Land use	Total acres	Acres adequately treated	Acres remaining to be treated	Percent needing treatment
Cropland	466,300	100,400	365,900	79
Pasture land	194,165	29,100	165,065	85
Forest land	305,600	45,800	259,800	85
Other agriculture	33,815	11,200	22,615	66
Total agricultural	999,880	186,500	813,380	81

Sources: Conservation Needs Inventory - 1966, unadjusted, and Forest Survey for Tennessee, 1961, and Mississippi, 1966.

The estimated cropland and grassland acres needing treatment by different kinds of conservation measures are shown for the major drainage areas of the basin in Table 5.2. The measures needed for cropland range from simple practices, such as crop residue management and annual cover, to more intensive treatment, such as stripcropping, terracing, and diversions. Needed grassland measures range from management for increased hay and grazing production, to more intensive practices to control active erosion. Some areas will require complete reestablishment of adapted grasses and legumes. Others need to be converted to forest because of extreme slope and erosion conditions.

It is estimated that 20 percent of the cultivated uplands and 8 percent of the pastured uplands should be converted to a less intensive use. This would include converting 50,760 acres of cropland to pastureland, and 22,240 acres of cropland and pastureland to woodland.

While it was more feasible to compile conservation treatment needs by major subbasins in Table 5.2, the kinds of conservation measures and practices needed in different portions of the study area are more directly related to the erosion problem areas as shown in Figure 4.1. In fact, a major reason for the delineation of problem areas was to reflect the difference in kinds of conservation measures needed. In the rapidly urbanizing part of the basin designated as erosion problem area 1, there is a need for careful planning for urban development that would take into account soil conditions, surface water management, and other environmental factors.

4-30376

Table 5.2 - Conservation land treatment needs on agricultural lands 1/
Chickasaw-Metropolitan Surface Water Management Survey

	Cropland acres							
Sub-basins	Land adequately treated	Residue and annual cover management	Sod rotation	Contouring only	Stripping terracing and/or diversion	Change to permanent cover	Drainage system needed	Total
Loosahatchie River	46,600	49,000	27,000	7,100	58,900	15,200	19,000	222,800
Wolf River	36,100	21,100	14,800	1,400	56,800	21,900	22,000	174,100
Nonconnah-Horn Lake	17,600	12,700	700	5,800	11,300	15,000	6,300	69,400
Total	100,300	82,800	42,500	14,300	127,000	52,100	47,300	466,300

	Grassland acres						
Sub-basins	No treatment needed	Protection from over-grazing	Stand improve-ment	Brush and weed control	Reestab-lishment of grass and legumes	Change land use	Total
Loosahatchie River	13,400	7,765	13,200	3,500	23,200	700	61,765
Wolf River	9,400	4,300	26,300	4,000	48,200	6,400	98,600
Nonconnah-Horn Lake	6,300	4,100	10,800	200	11,700	700	33,800
Total	29,100	16,165	50,300	7,700	83,100	7,800	194,165

1/ From unadjusted Conservation Needs Inventory, 1966

Local policies, guidelines, and regulations are needed to control erosion and prevent sedimentation while construction projects are under way. These restraints are also needed to assure sound surface water management. Such planning should take into account the needs for reserving open space areas which would otherwise be covered by urban growth.

The Memphis and Shelby County Planning Commission has estimated that 3,600 acres of land is being developed annually for urban and industrial uses. The soils exposed by construction in these areas are highly vulnerable to erosion. Sediment damages resulting from soil losses by erosion occur on and off the development site itself, and may extend many miles downstream in the form of damage to stream channels, reservoirs and water quality. The specific treatment measures required to control erosion on these construction areas will vary by type of development and development sites. Some of the measures that may be needed are: vegetative cover, the construction of diversions, the development of vegetative waterways, grade control structures, channel lining, riprapping, and the construction of floodwater retarding and sediment detention structures. Practical combinations of the above measures, together with other measures, will be needed. Where possible, the existing woodlands should be maintained to prevent future soil erosion. Greenbelts of trees, shrubs, or grasses are needed to break slopes and control surface water runoff.

The middle portion of the basin is designated as erosion problem area 2. Conservation measures for this agricultural area must be selected based on the highly erosive nature of the fine, silty soils and their adaptability to general crop farming. The type of practices needed in this area include mulch planting, minimum tillage, crop residue management, annual cover crops, contour farming, parallel terraces, grass waterways, stripcropping, and diversions. New kinds of conservation measures compatible with the use of modern, mechanized equipment and large scale farming operations are also needed. These could include land shaping and forming, chisel plows, the use of mulch and residue planters, and the use of improved residue-producing plants.

It is estimated that 70 percent of the critical erosion treatment and sediment prevention needs occur in the eastern third of the basin designated as erosion problem area 3. Land treatment needs are similar to those of the mid-portion of the basin, but will require a generally more intensive approach because of the greater erosion potential. Critically eroding areas include gullies, roadsides, and some extremely severe sheet eroded areas. The treatment of many of these areas will require a change in land use to trees or other permanent vegetation. Sediment traps and debris basins will be needed to control erosion and sediment from the worst areas.

It is significant that only 32 percent of the land produces 79 percent of the gross erosion, while 68 percent of the land having slight to moderate sheet erosion produces only 21 percent of the gross erosion. This emphasizes the need for priority treatment of the critically eroding areas of

Farm conservation planning needs to be accelerated on 813,380 acres of the agricultural lands of the basin.

Sod waterways are needed to control erosion in natural drainageways.

4-30376

This critically eroding area in a watershed was planted to pines under provisions of Public Law 566 in February 1966. After five years growth movement of sediment from the site was under control.

4-30376

the basin. The cost of treatment of such critical areas usually exceeds the increased monetary returns, and for that reason these lands are the last to receive the owners attention.

CRITICAL AREA TREATMENT

About 183,475 acres of critically eroding land is in need of treatment. This includes gullies, roadbanks, severe sheet erosion, and other areas of critical erosion. This area contributes 6,325,000 tons gross erosion annually. The intensity of this erosion due to the soil types, slope conditions, rainfall intensity, and farming practices creates the necessity for early effective treatment to reduce soil loss and the resulting sedimentation. The problems are more intense and treatment needs are greatest in the upper reaches of the basin where coarse soils aggravate sediment problems.

Critical area treatment needs include shaping, smoothing, liming, fertilizing, and planting grasses and legumes on about 50,000 acres. Tree planting or other permanent cover planting is needed on approximately 32,000 acres. Severe sheet erosion on 100,000 acres of cropland would require conservation systems of terraces, stripcropping, waterways, conservation rotations, and minimum tillage to accomplish effective control. Roadside stabilization consisting of shaping, sloping, and establishing permanent vegetative cover is needed on about 1,400 acres. It is estimated that 2,700 gully plugs, desilting basins, or sediment traps are needed to stabilize the larger gullies.

Some critical areas need to be vegetated with plants that provide wildlife food and cover. Eroded areas being planted to trees need wildlife food plants established on selected spots higher in fertility. Hedgerows that produce wildlife food and cover may be used as fences to protect critically eroded areas from grazing by livestock.

FOREST PROTECTION AND IMPROVEMENT

Present treatment of forest land is adequate on only about 45,800 acres. There remains another 259,800 acres of forest in need of one or more of the forestry measures. Table 5.3 summarizes forestry needs.

The three categories of forestry needs are protection, improvement, and urban environmental enhancement. For forest land to make its contribution to water resource protection, woodlands must be protected from fire, livestock, and insect and disease infestation, and critically eroding areas must be healed.

Fire protection has been provided in all basin counties for several years. No counties report unusual problems and fire records show none. However, fire scars reduce esthetic values of forest trees on land destined as potential home sites. Such fires are frequent in association with urbanization and are not recorded in rural and forest fire statistics. The

need for fire protection is to maintain the current goal of less than 0.20 percent annual burn and eventually reduce it further to 0.15 percent or no more than 460 acres of forest burned annually in the basin.

Protection from grazing livestock is needed on 51,700 acres or 16 percent of the basin forest. With the exception of critical area treatment, the greatest impact on protection of the forest soil can result from controlling wildfire and livestock grazing.

Critical rates of erosion were estimated to occur on 11,870 acres of forest land. In addition, gullies needing forestry treatment were estimated to total 3,000 acres. All of this land needs tree planting.

Additional protection from insects or diseases will be needed as forests are harvested or in the event an outbreak of a serious nature occurs. No such outbreak is now foreseen. However, in the urban area, damage to the environmental values of forest trees from otherwise unimportant insects or diseases can be serious. A special project for continual watch and advisory service on control of such pests is needed as areas become urban. The area involved in this need is in the city limits and its metropolitan outskirts, including all of Shelby County.

The improvement needs of the basin include harvesting, forest stand improvement, stand conversion, and environmental enhancement. These measures either develop improved forests soil conditions or maintain these conditions.

Studies of harvesting rates in this area indicate that 70,000 acres are considered by landowners for harvesting each year. Of this, 28 percent or 20,000 acres must actually receive some degree of cutting to provide the logs used to meet the annual cut. An average of less than half the volume must be removed from each of the cutover acres. Disposal of slash and other logging debris, location of skid trails and roads so as not to cause or accelerate erosion, and treatment of stumps to prevent disease spread needs to become an everyday part of logging activity on the 20,000 acres each year. Closer supervision of logging operations would help substantially toward satisfying these needs.

The culture of forest lands often requires the removal of trees through the use of herbicides and sometimes replacement of one species of tree by the planting of another. About 170,000 acres need timber stand improvement work in some degree. An additional 5,700 acres need to be converted to more suitable species. This work is nearly all confined to the mid and upper portions of the basin. The 5,700 acres of type conversion is in the very upper basin where sites are eroded and soils are coastal plain in type.

Planting to improve stocking is needed on an estimated 23,130 acres in the mid and upper basin in addition to the 11,870 acres of critical area and 3,000 acres of gully tree planting.

Nearly all of the needed forestry program applies to the middle and upper parts of the basin. There are 11,840 acres of national forest under management and protection. Forests in the urbanizing part of the basin are not expected to remain as forest. Forestry, however, does have a role in the growth and development of the city. As cities grow, wooded home sites are available only where woods exist before urbanization. The exception is where great costs are incurred to transplant large trees. Development, however, often proceeds without regard for the esthetic and shade-producing benefits of existing trees. There is need for a concerted effort to encourage developers to retain shade and cover as homes and apartments are built. Trees also intercept rainfall and aid in control of erosion when soil is disturbed during development.

Buffer strips of woodland in narrow widths that would intercept overland flow will filter out sediment resulting from urban connected erosion. Also around industrial parks, along noisy highways, airports, and railyards, trees can be used to reduce noise and screen the unsightly sides of industrial enterprises.

4-30376

Table 5.3 - Forest management needs *
Chickasaw-Metropolitan Surface Water Management Survey

Protection	Acres needing treatment		
Fire (allowable burn of 460 acres annually)	460	Annual maximum	
Livestock	51,700		
Insects and diseases	305,900	(with extra urban needs)	
Gully planting	3,000		
Improvement			
Harvesting assistance	70,000	Annually	
Timber stand improvement	170,000		
Type conversion	5,700		
Forestation - Non-critical area			23,130
Critical			11,870
			35,000
Environmental enhancement (Urban area)			
Buffer strips	Areas not determined		
Noise barriers	Areas not determined		
Urban parks	Areas not determined		

* Does not include national forest

An intensive conservation education and information program is needed to encourage application of conservation practices. This education program should reach urban citizens, government officials, youth groups, rural non- farm, and farm families. Garden clubs, civic groups, local and state planning organizations, institutions of higher learning, local television and radio stations, newspapers, and magazines need to be informed on the problems, needs, and potentials of soil conservation in the Chickasaw-Metropolitan study area. Special consideration should be given to increasing and intensifying conservation education in the secondary and elementary schools of the basin.

Flood Damage Prevention

Flood damage prevention is a major need in the Chickasaw-Metropolitan Basin. The needs include watershed protection and flood prevention developments, flood plain management to prevent further increase of damageable values exposed to flooding, especially in urban areas, and the possible use of flood control reservoirs on the Wolf and Loosahatchie Rivers. The needs for flood prevention vary with the kinds of use being made of the 128,000 acres of flood plain land on which occurs about two million dollars annual flood damage.

Protection that would reduce flooding to an average of once in a three-year period during the crop growing season is needed in the upstream agricultural areas. A higher level of control to protect against floods of the 100-year frequency is needed in the urban and urbanizing flood plains. The needed level of protection is based on present and projected developments and the environmental effects desired. Flood prevention needs are also determined by their effects on fish and wildlife, the agricultural economy, and rural community development.

Flood protection needs were analyzed separately for Nonconnah and Horn Lake Creeks, Wolf and Loosahatchie Rivers. Watershed investigations were made in eight watersheds including Nonconnah Creek, Horn Lake Creek, Big Creek, Beaver Creek, Bennetts Creek, Upper Loosahatchie, Upper Reach Wolf River, and Lower Reach Wolf River. Other investigations covered the flood plains of the Loosahatchie River and some of its tributary watersheds. The investigations revealed needs for flood protection in all watersheds investigated. They also revealed a need for early action to halt recurring floods and prevent steeply rising annual damages as development progresses in the flood plains.

Loosahatchie River Subbasin - While flood prevention is needed throughout the Loosahatchie River Subbasin, watershed investigations indicated that only four small watershed projects were physically and economically feasible. These were Big Creek, Beaver Creek, Upper Loosahatchie River, and Bennetts Creek Watersheds. The needs within these watersheds ranged from protection of agricultural flood plains during the cropping season against untimely seasonal floods and high sediment damages from infertile overwash, to improved environmental quality and protection of urban values in the city of Millington.

Flood protection along the main stem Loosahatchie flood plains is a continuing need, but the investigations did not show this to be economically feasible at the present time due to the fact that most flooding occurs during the winter months after crops are harvested. If future developments and more intensive land use occurs in the flood plains, it is possible that flood prevention projects would become feasible.

The Soil Conservation Service prepared a Flood Plain Information Report for Loosahatchie River, which delineates the area inundated by the 100-year flood and shows flood profile elevations. The report covers the history of flooding and offers general guidelines for reducing and preventing flood damages.

Wolf River Subbasin - Flood prevention is needed on the tributaries and main stem of Wolf River. Watershed project developments should include watershed protection against sediment that chokes the channels and aggravates flooding. Floodwater-retarding reservoirs, silt detention basins, and debris basins are needed in conjunction with channel restoration.

Flood prevention is needed on about 40 percent of the total flood plain lands of the Wolf River Subbasin to protect crops and pastures. Most of this area is upstream from the mouth of Grays Creek near Germantown.

Below Grays Creek, where the channel was enlarged by the U. S. Corps of Engineers, flooding of agricultural lands is less frequent. Further flood control development will be needed, however, in the Shelby County reaches where the pressures for urban development are occurring. There is also a definite need to restrict flood plain development in these lower reaches to prevent increased flood damages.

The needs for flood control measures on the main stem flood plains of the Wolf River are related to development needs on the lower reaches. A four-foot reduction of flood crests in the Shelby County reaches, assuming a 1,500-foot floodway width, would require major floodwater-detention structures in conjunction with channel rehabilitation. Protection against the 100-year frequency flood below the mouth of Grays Creek to the Mississippi River backwater would require additional storage on Wolf River itself.

The Wolf River Flood Plain Information Report, developed by the Soil Conservation Service during the course of the Chickasaw Basin survey, predicts future flooding and outlines needed action to curb damages that increase with continuing developments in the flood plain.

Nonconnah Creek - Nonconnah Creek Watershed lies between the downtown urban area of Memphis and the rapidly developing Airport-Whitehaven area on the south side. The strategic location of the Nonconnah Creek flood plain for commercial and industrial development, its relationship to rail, air, and highway transportation, and the property values already within the flood plain emphasize the critical need for flood damage prevention. Since the greatest flood hazard in terms of dollar values exists on the Nonconnah Creek flood plain, the greatest flood prevention needs in the basin are probably here also.

A Flood Plain Information Report for Nonconnah Creek, prepared by the Soil Conservation Service, has outlined three approaches to reduce flood damages. These are: (1) a combination of preventive measures, such as flood plain regulations and greenbelts. This type of program would restrict future development within the high damage zones, provide the basis for insurance protection to homes and businesses presently located within the high damage zone, and provide recreation areas. This approach would require that a majority of the remaining undeveloped flood plains remain open; (2) a combination of corrective measures such as those set forth in the watershed investigation report prepared by the Soil Conservation Service. This report indicated the feasibility of project development under Public Law 566, The Watershed Protection and Flood Prevention Act. This combination-type program is needed to eliminate the threat of damage from the 100-year flood. It is needed to protect existing residential and commercial developments as well as to allow for future expansion on the 1,800 acres of

flood plain exposed to flooding; and (3) a combination of both preventive and corrective measures.

Horn Lake Creek - Horn Lake Creek Watershed is expected to become fully urbanized by about the year 2000. Some portions of the flood plain are inundated several times a year. About a third of the 3,000-acre flood plain is flooded on the average of once a year. Floodwater storage and channel enlargement are needed to provide protection against the 100-year frequency flood. Flood plain management is needed to prevent further development of damageable values in the flood plains. A watershed investigation report prepared for Horn Lake Creek Watershed revealed that a PL-566 project was not economically feasible at the present time.

Drainage Improvement

Approximately 336,700 acres of urban and agricultural land in the Chickasaw-Metropolitan Basin has excess water problems that limit its use. Poor drainage, high water table, and susceptibility to flooding interfere with plant growth and cultivation, and limit the use of the land for farming, residential, industrial, or transportational uses. It is estimated that 47,300 acres of cropland, 22,000 acres of pastureland, 7,000 acres of other, and 17,000 acres of existing woodland that are expected to be cleared for other uses have a need for adequate surface drainage systems.

Drainage needs include a system of "V" or "W" ditches, usually in combination with trapezoidal outlet ditches. Land grading, shaping, and smoothing are needed to prevent surface water ponding, especially in fields that are to be intensively cultivated for production of high quality vegetables and other crops. As irrigation becomes more important for production, precision land leveling and drainage will be needed to assure adequate disposal of surface water.

Outlets are generally adequate for drainage on the four main streams of the basin. However, many tributaries of the Wolf and Loosahatchie Rivers have channels filled with sand and sediment deposits that interfere with drainage. The Wolf River from Rossville east to its headwaters in Mississippi has inadequate channel capacities due to sand deposits. There is a need for channel improvement for drainage on selected tributaries and reaches of the Wolf River. Maintenance of these outlets and drainage channels will require effective conservation practices to control erosion and prevent obstruction by sediment. Installation and maintenance costs of drainage practices are usually a profitable investment by improving agricultural efficiencies. In urbanizing areas, drainage is needed for pollution, disease and insect control, and to improve the local environment.

Irrigation

The average annual rainfall for the study area is 52 inches. However, this rainfall is not distributed uniformly throughout the growing season. Lack of sufficient soil moisture during parts of the growing season reduces yields and sometimes causes crop failures. Evapotranspiration requirements are greater during the hot months of the crop growing season. This often gives rise to drought conditions at the very time when plants are most in need of water. Table 5.4 gives, at different levels of probability, the number of drought days each month from April through October for soils with different available water capacities. The average available water capacity for the Chickasaw-Metropolitan Basin soils is 0.25 inches per inch of soil. Thus, if a plant needs from one to two inches of available moisture for maximum plant growth, a check of Table 5.4 will determine the probability of drought days during the month. It can be readily seen that there is a 5 in 10 probability of needing supplemental irrigation water during 15 or 20 days in the month of July.

The rate of plant growth is affected greatly by the amount of available moisture in the soil. The vertical distance between the actual and potential evapotranspiration curve in Figure 5.1 is an indication of irrigation needs for the respective months for maximum plant growth. For the months of June, July, August, and September, 3.43 inches of water is needed to sustain maximum plant growth and to maintain the original 4 inches of available moisture.

This soil moisture deficit is due to the fact that precipitation is not sufficient during the summer months to replace the amount lost from the soil by evaporation and to meet the needs of growing plants.

Figure 5.2, Crop Moisture Index, shows the presence of drought in West Tennessee for 1969. The index indicates that "extreme drought" was reached about a month before the passage of hurricane Camille, with an index of -4.7 for the week ending July 19.

In 1964, 36 farms were reported by the U. S. Census of Agriculture as irrigating 539 acres of land. As changes occur in farming patterns and there is a shift to vegetable and other crops that are more sensitive to water requirements for quality, quantity, and income efficiencies, there will be a need for additional irrigation. As agricultural technology and better management methods are developed, soil moisture deficiency is likely to become a more generally limiting factor in crop yields.

Table 5.4 - Probabilities of drought days on soil of different available moisture capacity
Chickasaw-Metropolitan Surface Water Management Survey

(Dashes indicate less than 1 drought day)

Month 1/	Probability	Minimum drought days if soil has available moisture capacity in the root zone of--				
		1 inch	2 inches	3 inches	4 inches	5 inches
April	1 in 10	14	7	-	-	-
	2 in 10	11	2	-	-	-
	3 in 10	9	-	-	-	-
	5 in 10	5	-	-	-	-
May	1 in 10	22	17	12	5	-
	2 in 10	18	13	6	-	-
	3 in 10	16	10	3	-	-
	5 in 10	11	5	-	-	-
June	1 in 10	29	29	25	22	18
	2 in 10	25	23	21	17	11
	3 in 10	23	20	18	13	7
	5 in 10	18	14	11	6	-
July	1 in 10	29	29	29	29	27
	2 in 10	25	25	23	22	21
	3 in 10	23	21	19	17	16
	5 in 10	20	15	13	10	8
August	1 in 10	29	29	29	28	26
	2 in 10	26	25	25	24	23
	3 in 10	24	22	21	20	20
	5 in 10	20	17	15	14	13
September	1 in 10	27	26	26	26	26
	2 in 10	23	22	22	21	21
	3 in 10	20	19	19	18	18
	5 in 10	16	13	12	11	10
October	1 in 10	25	24	22	22	22
	2 in 10	21	20	18	18	18
	3 in 10	17	16	14	14	14
	5 in 10	12	9	6	5	5

1/ January, February, March, November, and December not shown because crops are rarely damaged by drought in these months.

From Soil Survey, Fayette County, Tennessee

4-30376

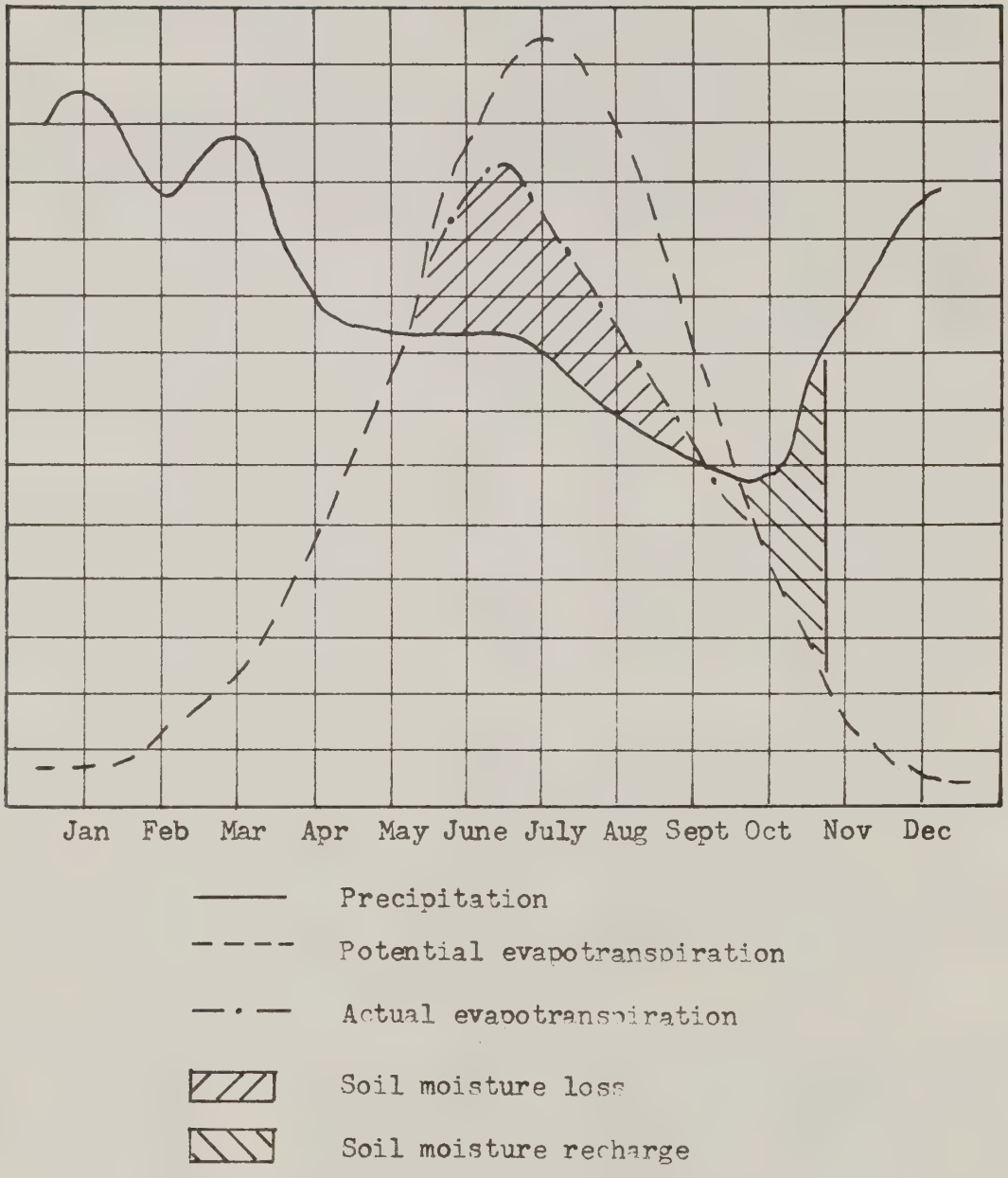


Figure 5.1 - Average precipitation and evapotranspiration at Moscow, Tennessee, computed from data recorded in the period from 1931 through 1955. Available waterholding capacity assumed to be 4 inches. (From Soil Survey, Fayette County, Tennessee)

Chickasaw-Metropolitan Surface Water Management Survey

4-30376

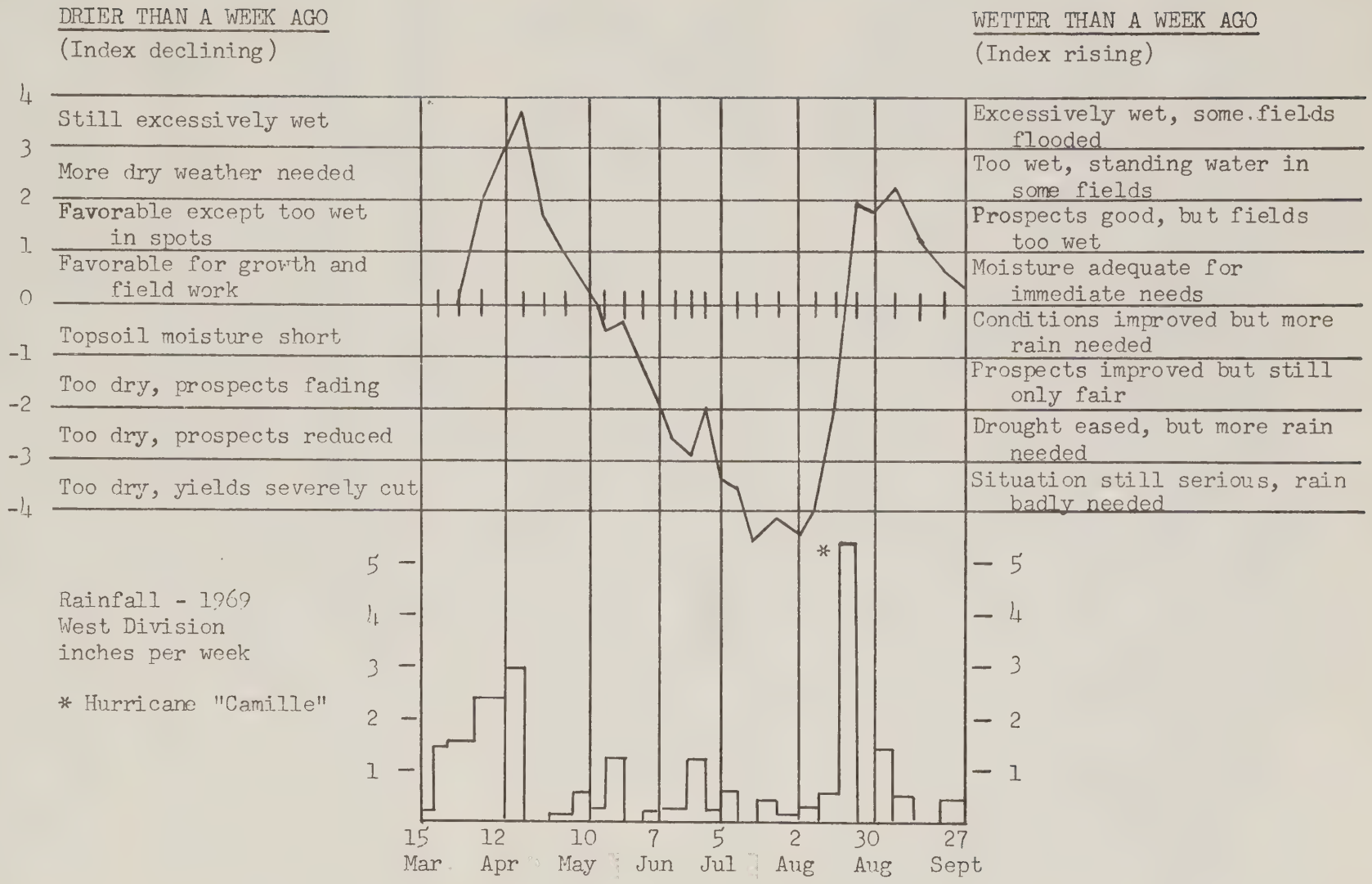


Figure 5.2 - Crop moisture index from Tennessee Weather and Crops, 1969
Chickasaw-Metropolitan Surface Water Management Survey

Water Supply

The present supply of water for livestock and domestic needs is adequate in most sections of the basin. Shallow wells, averaging 100 feet in depth and becoming progressively deeper from the eastern side of the basin to the western side, drilled into the rechargeable water-bearing sands, produce an abundant supply of water, free of harmful bacteria and low in sulphates and chlorides. This water supply is not immediately dependent upon the quantity of rainfall and has very favorable economic considerations for developing wells as a means of meeting industrial, municipal, and rural water needs. Memphis Light, Gas and Water System pumped 30 billion gallons of water in 1969. This is estimated to be about 50 percent of the total water use in the Memphis area. An estimated 10 percent of water removed is taken from the 1400-foot sands which yield a high quality water, but is less desirable due to increased temperatures and more solids. It is also estimated that by 1990 the 500-foot aquifers will reach non-artesian conditions, but at the same time, intake into the sands will improve due to the lowering of internal pressures.

In the rural areas of the Chickasaw-Metropolitan Basin, development needs include better distribution of livestock water facilities for improved grassland management. Livestock water need is anticipated to double by 2020 with projected increases in the production of livestock products.

Several rural communities and towns have water districts. Some of them have found revenues to be too low to repay obligations. Some farmers have found it more economical to drill their own wells for farm consumptive use. There is a need to review water supply developments to assure clean water at reasonable cost. Sewage disposal needs should be considered and provided with water supply developments.

With the abundant supply of ground water there is no need for water supply reservoirs except for farm ponds which can be located to supply livestock water and provide better distribution of grazing.

Table 5.5 presents estimated need for both domestic and livestock daily water needs.

Table 5.5 - Projected daily water needs
Chickasaw-Metropolitan Surface Water Management Survey

Type of use	Used 1964	Projected needs 1980	2000	2020
	(Thousand gallons)			
Rural domestic 1/	6,464	6,595	7,095	7,650
Municipal 2/ (public-supplied)	71,964	136,000	215,000	294,000
Industrial 3/ (self-supplied)	75,000	136,000	210,000	285,000
Agriculture:				
Irrigation 4/	1,218	1,760	2,200	2,494
Livestock	1,840	2,240	2,327	2,050
Total	156,486	282,595	436,622	591,194

1/ Includes unincorporated towns, cities of less than 2,000 and rural areas.
2/ Memphis Light, Gas and Water Company
3/ Includes all other drilled wells witnin the city of Memphis, other than the Memphis Light, Gas and Water system.
4/ Based upon 325,828 gallons per acre foot average, using 1.6 acre feet per irrigated acre. Irrigated acres projected to double from 1964 to 2020.

Water Quality Control

The Chickasaw-Metropolitan Basin streams and lakes have many uses which are necessary in the public interest. These uses include water supply for livestock, irrigation, industrial purposes, fish and wildlife, recreation, disposal of municipal sewage and industrial waste, and the esthetic enjoyment by man. The rigid application of strict and uniform water quality is not desirable or reasonable because of the varying uses of such waters and the economic costs of pollution controls to achieve maximum pristine water conditions. Standards and improvement goals need to be set for each of the basin streams and tributaries based on volume of flow, depth of channel, rate of flow, temperature, natural characteristics, geographic location and the nature of the stream and its major uses.

Improvement in sewer collection and treatment systems for the cities of Memphis, Southaven, Bartlett, Germantown, Collierville, Somerville, Oakland, and Millington are needed. The cooperation of the general public is needed to control dumping of garbage and waste materials, and to control the careless use of insecticides, herbicides, and other poisons.

Based on a report prepared by the Memphis and Shelby County Health Department, Pollution of Surface Waters in Memphis and Shelby County, April, 1969, there is a need for improvement in waste water discharges by most industries. More information and better standards are needed, including the effects each industry has on water quality.

The 8 million tons of sediment derived from agricultural lands, critical areas, roadbanks, and urban development have an obvious impact on water quality. Land treatment and structural controls are needed to reduce the amount of sediment reaching the streams in the basin. One of the greatest offenders of water quality in Fletcher Creek, Nonconnah Creek, Johns Creek, and Wolf River is the material discharged from sand and gravel pits. Measures are needed to eliminate the discharge of this material into the streams. Settling basins could be used as one method of removing most of the fine silt and clay material that damages water quality and impairs the esthetic value of streams. While the old saying that "solution to pollution is dilution" has several fallacies, water storage for pollution abatement may be needed on certain streams and tributaries.

Where large reservoirs for recreation are being planned, there may be needs for upstream sediment storage reservoirs. These secondary structures would enhance the water quality and provide some incidental recreation.

Recreation

Although a considerable acreage of land and water has been developed for outdoor recreation in the Chickasaw-Metropolitan Basin, the developed areas are inadequate to supply the present and increasing demands of the growing population. The major demands arise from the population concentrated in the Memphis metropolitan area which sees an exodus each weekend and holiday to recreation areas in Arkansas, Mississippi, and along the Tennessee River.

The Hatchie River Basin, averaging about 60 miles from Memphis, was studied in conjunction with the Chickasaw Basin because of its proximity and the overlapping demands for recreation. These demands were established in Chapter III. They show needs for additional recreation facilities in the combined basins for boating, swimming, camping, and picnicking to satisfy 1.3 million recreation days in 1980, 2 million by the year 2000, and 3.3 million by 2020. This would require 11,000 acres of additional land and 12,200 acres of additional water by the year 2020. Table 5.6 shows the projected land and water needs for different recreation activities for both basins.

Table 5.6 - Additional land and water needs by recreation activity in combined Chickasaw and Hatchie River Basins, 1980, 2000, 2020

Activity	1980		2000		2020	
	Land	Water	Land	Water	Land	Water
	Acres	Acres	Acres	Acres	Acres	Acres
Boating	272	5,433	410	8,200	600	12,150
Swimming	14	5	64	16	134	24
Camping	2,060	-	2,940	-	4,200	-
Picnicking	2,525	-	3,715	-	5,414	-
Total	4,871	5,438	7,129	8,216	10,348	12,174

Habitat for fish production to satisfy the fishing demand shown in Chapter III is presented in Table 5.7 by habitat types. Acreage in the mainstream and tributaries cannot practically be increased, but the quality of the habitat can be improved by erosion control in the watershed. The remainder of the demand will have to be satisfied with intensively managed ponds and reservoirs in the acreage as shown in Table 5.7.

Table 5.7 Man-day fishing and habitat acreage need projected to year 2020 Chickasaw-Metropolitan and Hatchie River Basins

Year	Needs 1/	Mainstream 2/	Major tributaries 3/	Ponds and reservoirs 4/	
	M/D	M/D	M/D	M/D	Acres
1980	1,821,108	49,310	14,145	1,849,383	17,613
2000	2,656,604	49,310	14,145	2,717,449	25,881
2020	3,875,895	49,310	14,145	3,981,840	37,922

1/ Man-day needs totals from table "Freshwater Fishing Demand and Capacities Without Additional Habitat", by Tennessee Game and Fish Commission and River Basin Division, Bureau of Sports Fisheries and Wildlife.

2/ Use of mainstreams would increase to about 20 M/D per acre in Chickasaw-Metropolitan and 45 M/D per acre in the Hatchie with pollution controlled to meet water quality standards, public access provided, and the present stream channel morphology remain with minimum alteration.

3/ Use of major tributaries would increase to about 15 M/D per acre with the same measures applied as for the mainstream.

4/ Use factor applied is 105 M/D per acre which is for impounded water intensively managed for fish production, supported by data from Tennessee Game and Fish Commission managed lakes.

4-30376

The area needed for hunting was projected from hunting records supplied by the biology work group and from population projections. Consideration was given to future availability of hunting areas and a slightly reduced participation by the increased proportion of urban population. A further consideration was the present emphasis on preservation of wildlife species and natural habitat. These projections are presented in table 5.8.

Table 5.8 - Hunting acreage needs projected to year 2020
Chickasaw-Metropolitan and Hatchie Basins (Tennessee and Mississippi)

Year	Acreage
1960	349,000
1980	473,000
2000	613,000
2020	800,000

Other recreational activities that will require open space are playgrounds, neighborhood parks, regional parks, field sports, golf, scenic and historical areas, horseback riding, shooting, archery and vacation cottages. Many of these requirements will occur in the areas of concentrated population around Memphis.

Based on a projected basin population of 1,519,500 people by the year 2000, it is estimated that these other recreational activities will require 40,000 acres of land. This estimate is based on standard space requirements for outdoor recreational activities developed by George Nez, Director of Inter-County Regional Planning Commission, Denver, Colorado, and published in Urban Land, by Urban Land Institute. Table 5.9 shows the breakdown of these requirements for the Chickasaw-Metropolitan Basin and are given in gross estimations without present development being shown and is useful only as a guide.

Table 5.9 - Area needed for recreational development
Chickasaw-Metropolitan Surface Water Management Survey

Type of area	Acres needed	Size of site		Radius of area served
		Ideal	Minimum	
Playgrounds	2,280	4 acres	2 acres	0.5 miles
Neighborhood parks	3,050	10 acres	5 acres	0.5 miles
Community parks	5,300	100 acres	40 acres	2.0 miles
Regional parks and reservations	22,800	500-1000 acres		10.0 miles
Other - golf, historic areas, vacation cottages, etc.	6,570			
Total	40,000			

4-30376

About 8,000 additional acres of water will be needed to meet the demands for 2 million recreation man-days by the year 2000.

Field borders planted to adapted food and cover plants for wildlife can help to meet improved habitat needs.

4-30376

Definitions:

Neighborhood - An area served by one elementary school, usually counded by major or secondary streets, or other natural or artificial boundaries, population between 3,000 and 5,000 for average densities.

Community - Several neighborhoods served by one high school which generally is bounded by major natural or man-made boundaries; populations between 30,000 and 40,000.

Region - An area of two or more communities; 75,000 or more population.

Fish and Wildlife

Improvement of the surface water quality, flood control programs, wildlife habitat establishment programs, and an effective land use and treatment program are needed in the Chickasaw-Metropolitan Basin if the fish and wildlife resources are to survive the ecological changes brought about by projected population increases. Due to pollution and intermittent stream flow, fish habitat is limited to the upper reaches of Loosahatchie and Wolf Rivers, and on some tributaries and lakes. Higher densities of wildlife are found along forested streams in the rural areas.

Based on suggested standards for urban developments*, there is a need for one lake per 25,000 population with a minimum size of 20 acres for fishing, a 10-acre area per 1,000 population with a minimun size between 500 and 1,000 acres for nature and wildlife habitat developments. If these standards are correct, and population of the basin reaches the projected number of 1,519,500 people by the year 2000, 61 lakes of 20 acres minimum size for fisheries and 15,200 acres for nature and wildlife areas will be needed. These are needed in the form of large district or regional parks, or the small lakes could be developed in a community-park concept, making some fish and wildlife resources available to nearly everyone. Most of these needs can be provided within the basin but is likely that a part of these needs will be met with development in other areas.

Wildlife habitat in cropland and pastures needs to be improved. Food and/or cover should be provided by making use of odd areas, field boundaries, fencerows, ditch banks, woodland edges, farm ponds, and banks of streams. Cover is generally the limiting factor in cropland. Small dispersed areas of perhaps an eighth to a quarter of acre may be taken out of pasture, protected from livestock, and dedicated to wildlife habitat. By the year 2000, 54,700 acres of rural land needs to be in this use.

Wildlife management areas should be established on large acreages. These could be with private landowners with large land holdings, groups of

* Urban Land, by George Nez

cooperating landowners with small land holdings, or with publicly-owned or leased land operated by the appropriate public agencies. Private land will continue providing the major portion of the wildlife habitat; therefore, through public education, technical assistance and demonstration, the landowners should be encouraged to maintain wildlife habitat on their holdings. However, it should be developed into an economic reality for the landowner, paid for by the participating sportsmen. This could also include shooting preserve development as a more intensively-managed wildlife enterprise and small lakes intensively managed for fishing.

There is a need for access to the limited amounts of fishable waters in the basin. Improved access by acquiring public easements for greenways and trails along the streams is needed to facilitate the use for fishing.

Fish and wildlife developments for enhancement and preservation need to be given full consideration during the planning process for all flood prevention and control projects and should be incorporated as a project purpose in many of these reservoirs. Channel alterations should provide for mitigation of damages to fish and wildlife habitat insofar as possible. Pollution of the water and land resources needs to be reduced to a level that will not impair production of fish and wildlife resources. Use of chemical pesticides and herbicides and other poisons needs to be controlled and managed so that no damage occurs to fish and wildlife species.

Environmental Quality Improvement

The environmental quality of the basin is determined by the sum total of the natural resources and the effects of man's activities on these resources. These resources include water, land, air, fish, wildlife, vegetation, and recreational and esthetic values. Most of the development needs already discussed in this chapter would help to improve the quality of the basin environment.

The need to improve the scenic and esthetic beauty of the landscape by the establishment of vegetative cover could be met by land treatment measures including tree planting, establishment of perennial grasses and legumes, and erosion control measures. Ornamental plants are needed along highways, in parks and recreation areas, and on grounds of public and private institutions.

Sewage treatment and collection methods need improvement in Memphis and the towns of the basin. Primary, secondary, and advanced sewage treatment plants are needed in Memphis.

Controls are needed to reduce pollution of the atmosphere, most of which originates in Memphis and Shelby County. Over 600,000 tons of pollutants, billowing into the atmosphere from Shelby County each year, need to be reduced by cooperation of industry and government. A smelter company in north Shelby County and the TVA operated steam electric power plant at Memphis are among the industrial worst offenders. Automobile exhaust

emission and jet aircraft are other sources of air pollution. Efforts are underway already to reduce emanation of particles and noxious gases from all these sources.

Garbage collection and disposal is still an unsolved problem that affects the environment. All the towns of the basin and the city of Memphis need better disposal systems. Rural communities need to develop systematic collection systems with disposal areas selected for soil suitability, out of public view, and out of flood-prone areas.

There is a need to relate optimum population density to the environmental factors that provide for pleasant living. This approach is needed in place of rigid lot size restrictions in residential developments. Guidelines should be set on types, locations and construction of service facilities and recreation areas consistent with providing a better environment in urban areas. Developments need to be restricted or excluded from areas identified as having severe construction limitations such as unstable soil, erosion or flood hazards. Scenic easements, greenways, conservation areas, parks, trails, and historical sites need to be determined before development is allowed.

VI. EXISTING WATER AND RELATED LAND RESOURCE PROJECTS AND PROGRAMS

Programs already in operation are making significant contributions to the protection and development of water and related land resources in the basin. However, it is readily apparent that progress needs to be accelerated if major objectives are to be met. This is particularly true of the going land treatment programs where the Conservation Needs Inventory reveals that about four-fifths of the land remains to be treated. A basic cause of lagging land treatment is that landowners cannot afford the necessary immediate expenditures for long-range benefits, many of which accrue to the public rather than to the individual who must pay for them.

Only 24 percent of the needs for flood protection on agricultural lands of the basin have been met under existing programs. These programs include Public Law 566 watershed projects on Indian, Grays, and Roberson Creeks, pilot watershed projects on Sand and Mary's Creeks, and a channel improvement project in the Shelby County portion of Wolf River constructed by the Corps of Engineers. These projects will reduce annual flood damages to agriculture by $490,000 on an estimated 31,000 acres of flood plain land. This leaves about $1,400,000 in damages on 97,000 acres of flood plain land yet to be relieved. Solving these flood problems in a reasonable period of time to match development needs would require acceleration of current flood prevention programs.

U. S. Department of Agriculture Programs

PUBLIC LAW 74-46, The Soil Conservation Act

The primary function of the Soil Conservation Service, under Public Law 46 of the 74th Congress, as amended, is to assist landowners, communities, and institutions in planning, applying, and maintaining soil and water conservation on their lands. The Act was passed by Congress in April 1935. It formally recognized soil erosion as "a menace to national welfare" and declared as "policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands..."

Under this Act, the Soil Conservation Service provides technical assistance through soil conservation district programs. All counties in the Chickasaw Basin have organized soil conservation districts and are active in conservation districts and are active in conservation program developments.

Table 6.1 shows the estimated amount of conservation practices on the land as of June 30, 1969. These practices were installed with the assistance of federal, state, and local organizations, and through the efforts of the landowners and operators.

Table 6.1 - Estimated land treatment measures now on the land, as of June 30, 1969
Chickasaw-Metropolitan Surface Water Management Survey

Practice	Unit	Total
Conservation cropping system	Ac.	342,095
Contour farming	Ac.	73,288
Critical area planting	Ac.	112,665
Crop residue management	Ac.	314,464
Debris basin	No.	4,276
Pond	No.	6,828
Grassed waterway or outlet	Ac.	3,718
Land smoothing	Ac.	10,769
Minimum tillage	Ac.	70
Drainage main or lateral	Ft.	3,578,764
Pasture and hayland management	Ac.	273,837
Pasture and hayland planting	Ac.	195,040
Streambank protection	Ft.	1,608,449
Open channel	Ft.	743,877
Stripcropping	Ac.	818
Drainage field ditch	Ft.	1,684,366
Terrace, gradient	Ft.	3,792,282
Terrace, parallel	Ft.	24,402
Tree planting	Ac.	139,488
Wildlife wetland management	Ac.	105
Wildlife habitat management	Ac.	33,595
Woodland improved harvesting	Ac.	30,094
Woodland improvement	Ac.	87,518
Cropland to grassland	Ac.	36,986
Cropland to woodland	Ac.	1,850
Cropland to wildlife-recreation	Ac.	785
Cropland to "Other"	Ac.	7,357
All other uses to cropland	Ac.	29,152
All other uses (except cropland) to wildlife-recreation	Ac.	296

Source: Internal data, Soil Conservation Service

4-30376

PUBLIC LAW 83-566 PROJECTS

The Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended, provides technical and financial assistance to state or local organizations in planning, designing, and installing watershed improvement works. It provides cost sharing for flood prevention, irrigation, drainage, sedimentation control, fish and wildlife developments, and public recreation. Long-term credit to help local interests with their share of the costs, including costs of developing municipal and industrial water supplies, is also included.

Three Public Law 566 watershed projects have been approved for operations within the basin. Two projects have been completed and one is in operation. The following is a brief summary of these projects:

Indian Creek Watershed, a tributary of Wolf River, contains 22,000 acres and is located in Fayette and Hardeman Counties, Tennessee, and Benton County, Mississippi. This watershed was approved for operations on July 3, 1958, and was completed in fiscal year 1968. Major problems of the watershed consisted of damage from floodwater and sediment in the flood plain, establishment and maintenance of on-farm drainage systems, and excessive erosion on upland soils.

The works of improvement consist of (1) devoting land to uses for which it is suited and giving it the conservation treatment needed for sustained production, (2) stabilizing critical runoff and sediment producing areas, (3) installation of four floodwater-retarding structures, and (4) clearing, enlarging and realigning 15.28 miles of stream channel. Total installation cost of the project was estimated to be $596,540 with $168,270 for land treatment measures and $428,270 for structural measures. The total project has reduced average annual damage from $28,184 to $3,152 and has a benefit-cost ratio of 1.8:1.0.

Grays Creek Watershed has a drainage area of 23,638 acres and lies in the northwest portion of Benton County, Mississippi. The watershed is drained by Grays Creek which flows in a northerly direction into Wolf River. Major watershed problems consist of extensive sediment and floodwater damages to crops, pastures, and fixed improvements, and excess erosion on the upland areas. The watershed was approved for operations on March 9, 1959.

The planned works of improvement consist of (1) devoting land to uses for which it is suited and giving it the conservation treatment needed for sustained production, (2) stabilizing critical runoff and sediment-producing areas, (3) installation of ten floodwater-retarding structures, and (4) improvement of 17.8 miles of stream channel. Total installation cost of the project is estimated to be $1,139,714 with $535,653 for land treatment and $604,061 for structural measures. The total project will reduce average annual damages from $118,987 to $11,026. The ratio of average annual benefits to annual costs is 2.5:1.0. All of the planned

structural measures have been installed and approximately 78 percent of the land treatment measures have been applied. This project has been completed.

Roberson Creek Watershed has a drainage area of 25,910 acres and lies in the north-central portion of Benton County, Mississippi. The major problems of the watershed are (1) low farm income that affects the economy of the watershed and the surrounding area, (2) high floodwater and sediment damages to the flood plain, (3) extreme erosion on about 75 percent of the hill lands and extreme gully erosion and land depreciation, and (4) difficulty in establishing and maintaining ditches to remove floodwater from the flood plain.

The planned works of improvement consist of (1) devoting land to uses for which it is suited and giving it the conservation treatment needed for sustained production, (2) stabilizing critical runoff and sediment-producing areas, (3) installation of eight floodwater-retarding structures, (4) eight grade stabilization/sediment control structures, and (5) improvement of 23.54 miles of channel improvement.

Total installation cost of the project is estimated to be $1,621,174 of which $464,029 is for land treatment. The project will reduce average annual damage from $124,870 to $21,311. The ratio of average annual benefits to annual costs is 2.1:1.0.

This project was authorized for operations on July 23, 1969. As of October 1969, no progress had been reported. Estimated completion date is in fiscal year 1975.

PILOT WATERSHED PROJECT

Wolf River Tributaries - Sand and Mary's Creeks - These watersheds are Watershed Project No. 65 and were planned and installed under authority provided in Public Law 46, 74th Congress, and the watershed protection item in the Agricultural Appropriation Bill 1954, 83rd Congress, first session. Mary's Creek Watershed has a drainage area of 10,500 acres and Sand Creek Watershed has a drainage area of 4,400 acres. Major problems of the watersheds were extensive floodwater and sediment damages on flood plain lands and excessive erosion on the uplands. A plan was developed that called for (1) devoting land to uses for which it is suited and giving it the needed conservation treatment, (2) stabilizing critical runoff and sediment producing areas, (3) installation of 12 floodwater-retarding structures and 12.3 miles of stream channel improvements. Total installation cost of the project was estimated to be $870,762, including land treatment costs. Mary's Creek has a benefit-cost ratio of 1.3:1.0 and Sand Creek has a benefit-cost ratio of 1.4:1.0. This watershed project has been completed.

FARMERS HOME ADMINISTRATION

The Farmers Home Administration is a lending agency of the United States Department of Agriculture for providing credit and management aid to people in rural areas. The individual type loans that promote soil and water conservation are farm ownership, soil and water, and operating type loans. A large number of these loans have been made on individual farm units in the Chickasaw Basin for drainage work, and establishment and improvement of permanent pasture. The farm ownership loan program has been by far the largest program.

Three association loans have been made in the basin which provide for watershed development. Other association loans have been made in the basin which provide for rural water development and sanitary sewer systems.

AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE

The Rural Environmental Assistance Program is a program administered by the Agricultural Stabilization and Conservation Service that allows landowners and operators to participate with the federal government on a voluntary basis to install needed conservation practices on individual farms to help meet farm and watershed conservation goals. This program provides cost-share assistance to farmers in implementing soil, water, woodland, pollution abatement, and wildlife conservation practices on farm lands now in agricultural production; it does not apply to development of new or additional farm land. The cost of the conservation practice is generally shared equally between the federal government and the farmer. For some necessary conservation materials and services the cost-share may be advanced as a purchase order. The conservation practices must be performed satisfactorily by the farmers in accordance with applicable specifications, and maintained in accordance with good farming practices.

The Soil Conservation Service, U. S. Forest Service, State forestry agencies and extension service have responsibility for (a) helping to formulate the Rural Environmental Assistance Program and (b) carrying out certain of its technical phases. The Soil Conservation Service responsibility for technical phases of applying specified REAP practices on the land includes the following steps:

1. Determine whether the practice is needed and practical on a farm or ranch.
2. Necessary site selection, other preliminary work and layout of a practice.
3. Necessary supervision of installation.
4. Necessary checking and certification of performance.

4-30376

A loan by Farmers Home Administration replaced this substandard home with the new home shown below.

4-30376

Emergency conservation measures are authorized under the program in designated disaster areas, where needed, to rehabilitate farm land damaged by natural disasters. In 1968, parts of Fayette, Haywood, and Tipton Counties in Tennessee, were designated as disaster areas and a total of $98,799 was allocated to farmers in these areas.

The most common conservation practices in the Chickasaw Basin include establishment of protective vegetative cover (grasses and legumes for permanent pastures and summer and winter cover crops) or the improvement of existing protective cover, including the agricultural minerals required to establish these practices; construction of farm ponds; construction of improvement of drainage systems to dispose of excess water; and tree planting.

The Cropland Adjustment Program began in 1966 and was designed to help farmers divert cropland to protective conservation uses under long-term agreements for periods of 5 to 10 years. Congress did not appropriate funds for this program after 1967.

Other programs which have assisted farmers in the survey area have included the Conservation Reserve Program, under which long-term contracts (the last of which expired at the end of 1969) provided for diversion of cropland to conserving uses; and the annual Feed Grain, Wheat, and Upland Cotton Programs, under which (beginning in 1961) excess acreages of these crops have been diverted to conserving uses.

RESOURCE CONSERVATION AND DEVELOPMENT PROJECTS

The counties of Benton, Marshall, and Tippah in Mississippi, are included in the Northeast Mississippi Resource Conservation and Development Project. RC&D projects are developed under PL 46 (Soil Conservation Act) of the 74th Congress, PL-703 (Food and Agriculture Act of 1962) of the 87th Congress, and PL-796 (which amended the Bankhead-Jones Farm Tenant Act) of the 89th Congress. RC&D projects are designed to expand economic opportunities by developing and carrying out a plan of action for the conservation, improvement, development, and use of natural resources. The major objectives of the Northeast Mississippi RC&D projects are to promote outdoor recreation developments, conservation education workshops for schools, industrial park developments, community beautification, erosion control and treatment of critically-eroding areas, market development for vegetable and specialty crops, and interpretation of soil survey reports for towns and communities.

FOREST SERVICE

National Forests - There are approximately 11,840 acres of federally-owned land in the Holly Springs National Forest in Mississippi. All of this land is in the Wolf River drainage area of the Chickasaw-Metropolitan Basin. It is shown in Figure 6.1.

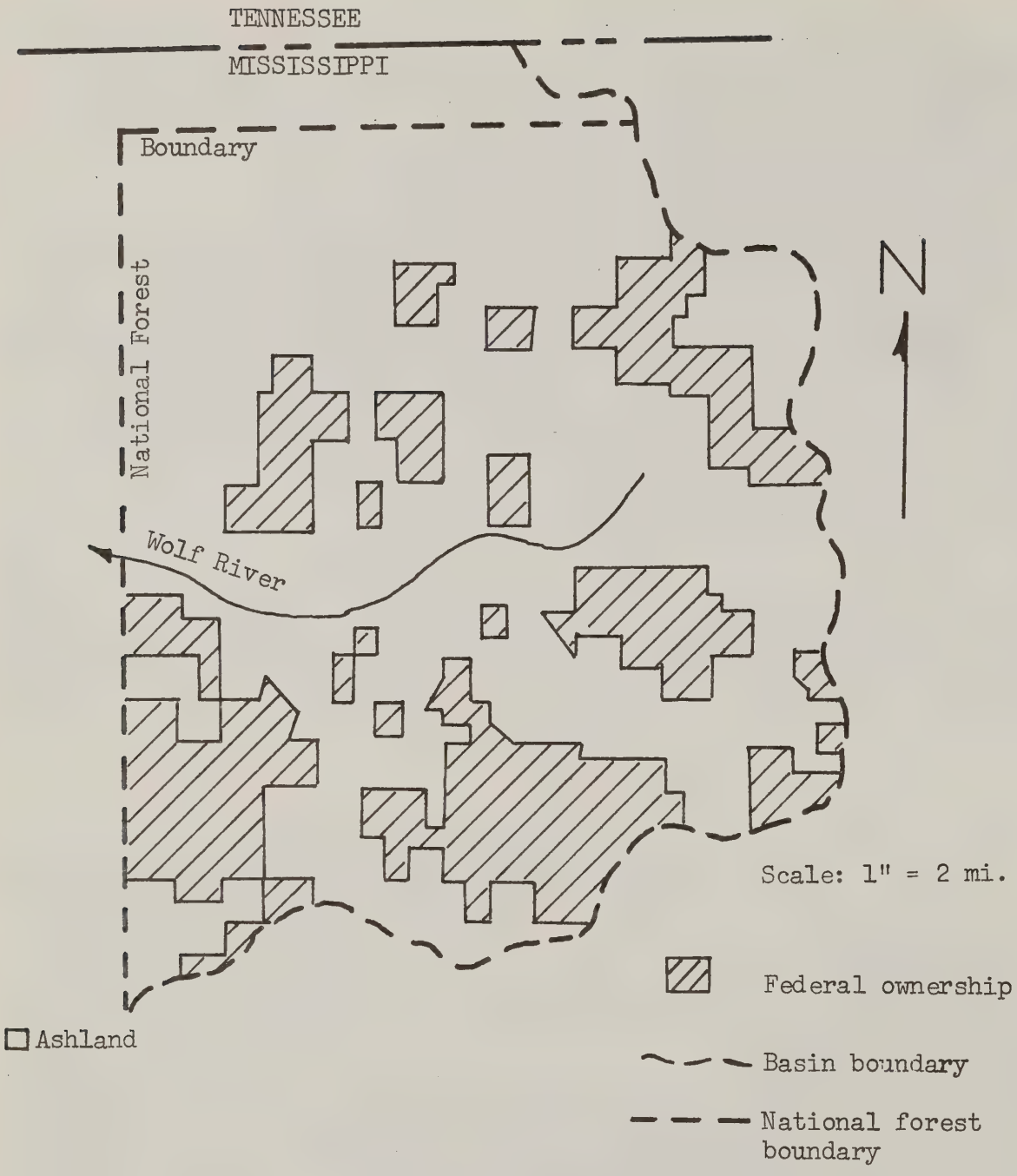


Figure 6.1 - Ownership pattern in the Holly Springs National Forest within the Chickasaw-Metropolitan Surface Water Management Survey area

4-30376

The National Forest Multiple Use Program includes forest fire protection, forest management, and tree planting as part of the overall protection and management program for the Holly Springs National Forest. It is unlikely that any recreation or other reservoir projects would be planned by the Forest Service on national forest land in the basin in the foreseeable future.

Forest Service Cooperative Program - The Forest Service through several state-federal cooperative programs provides services and assistance to landowners through the state forester. Federal authorization for cooperative forestry work includes:

(1) Cooperative Fire Control - Under the Clarke-McNary Act, (June 7, 1924, as amended) Section 2. Technical assistance and funds are available to the state forest fire organizations. This includes funds to share in the statewide and local cost of equipment and personnel. It also includes the availability of new fire training techniques and persons equipped to provide the training. Distribution of cooperative forest fire prevention materials (Smokey Bear Program) are channelled through this fire control organization.

(2) Cooperative Forest Management - The Cooperative Forest Management Act (August 25, 1950) provides for assisting states in providing technical forestry services to forest landowners. This also includes cost-sharing, and training activities in the area of timber management, sale contracts, logging and sawmilling, and generally any area related to culture and harvest of forest products.

(3) Nursery and Tree Seedling Production - Section 4 of the Clarke-McNary Act was extensively used to develop nurseries. Today, most of these have been taken over by the states. This is now a very small activity from the federal standpoint.

(4) Watershed Protection and Flood Prevention - Public Law 83-566 (August 4, 1954) enables the Forest Service to plan activities to accelerate the protection and development of good protective forest cover in PL-566 watersheds. The Forest Service makes field surveys to determine conditions and assist SCS in preparing plans for the 566 watersheds. This is implemented by the State foresters through their hiring of professional foresters. PL-566 funds are provided on a cost-sharing basis to make these extra technical services available to landowners in the planned and approved watersheds.

(5) Insect and Disease Control - The Forest Pest Control Act (June 25, 1947) provides for the Forest Service to assist in the control of forest insects and diseases. This includes making forest pest control specialists of the USDA available to states for identification and for planning controls for identified infestations. Cost-sharing to provide state forest pest control specialists is also done.

4-30376

With the exception of the field surveys for watersheds, all the work of the above programs is conducted with the landowners by the state forestry organizations.

U. S. Department of the Army

CORPS OF ENGINEERS PROGRAM

The Corps of Engineers has completed channel improvements to Wolf River from the mouth of Grays Creek (mile 38) to mile 3.5 near North Second Street in Memphis. This improvement consisted of realignment and excavation of a new channel with average bottom width of 65 feet and depth of 18 feet at Grays Creek to a bottom width of 100 feet and depths of 35 feet near North Second Street. A new diversion channel was excavated across Mud Island at mile 3.5 with the old outlet channel being closed by an earth dam.

These works of improvement were estimated to benefit some 15,400 acres of flood plain land within Shelby County and produce average annual benefits estimated at $185,400 (adjusted to 1968 prices).

U. S. Department of Interior Programs

BUREAU OF OUTDOOR RECREATION

Outdoor Recreation Water Resources Planning is provided according to the Outdoor Recreation Coordination and Development Act of May 28, 1963, and the Federal Water Project Recreation Act. The objectives are to assure that adequate assessment has been given to providing outdoor recreation and protecting natural beauty in the planning of projects, and that the project is consistent with national, regional, state, and local objectives.

Land and Water Conservation Fund Grants are made based on the Land and Water Conservation Fund Act of 1965. This program furnishes financial assistance grants to states and through them to their political subdivisions for outdoor recreation planning, land acquisition and facility development; and makes funds available to certain federal agencies for acquiring land and water areas for public outdoor recreation purposes and for preserving wildlife threatened with extinction.

State Programs and Projects

TENNESSEE GAME AND FISH COMMISSION

The objectives of the Game and Fish Commission are to protect, propagate, increase, and preserve the game, fish, fur-bearing animals, and other wildlife species, and to enforce the state laws relating thereto. Major activities of the Commission within the basin are the enforcement of game and fish laws; administration of an extensive wildlife management program

in Shelby Forest State Park, which has only a few acres within the basin; and management of the 177-acre Herb Parsons Lake, which supplied 22,000 fishing trips during 1970.

MISSISSIPPI GAME AND FISH COMMISSION

The Game and Fish Commission is charged with exclusive responsibility for the protection and propagation of native wild birds, wild animals, and fish and the preservation, increase, and use of these animals within the capacity of their habitat. Enforcement of the game laws is an important function within the basin. Game management programs have previously stocked deer and turkeys. The management of deer herds and the restoration of wild turkeys are major objectives in the basin along with maintenance of squirrels, raccoon, rabbit, and quail populations, fur-bearing animals and fish and their habitat.

AGRICULTURAL EXTENSION SERVICE

The Smith-Lever Act as amended provides the legislative authority for the Agricultural Extension Service. Objectives of the Extension Service, as they relate to natural resources, are to aid in diffusing among the people of the basin, useful and practical information on the conservation of natural resources; also, to assist in developing a realistic appreciation of the necessity for, and practical values of, the wise and non-depleting uses of natural resources. The Extension Service also encourages improved management of the resources on the farm and elsewhere, and aids farm operators to incorporate sound conservation measures into their own farm operations. Attempts are also made to develop a wider appreciation of both the economic and recreational values of natural resources, and the inherent values they offer to all people.

TENNESSEE DEPARTMENT OF CONSERVATION

The Planning and Development Division operates the Federal Land and Water Conservation Fund Program - Development and the State Parks Development, Operation and Maintenance Program. The major objectives of the State Parks Program within the Chickasaw Basin, are the development, operation, and maintenance of Tennessee parts of T. O. Fuller and Shelby Forest State Parks. The Planning and Development Division is the administering state agency for the Federal Land and Water Conservation Fund Program which is administered at the federal level by the Bureau of Outdoor Recreation. The objectives of this program are to assist in preserving, enlarging, developing, and assuring accessibility to quality outdoor recreation resources by providing funds for authorizing federal assistance to states in planning, acquisition, and development of needed land and water areas and providing funds for similar federal purposes.

The Division of Water Resources operates the Water Well Information and Water Use Programs. Major objectives of these programs are to gain a complete inventory of the state's water withdrawal and uses, and to log water wells as they are drilled to serve as a base on which water resources inventory reports are built.

STATE FORESTRY AGENCIES

The Division of Forestry of the Tennessee Department of Conservation and the Mississippi Forestry Commission administer the statewide forest conservation program for all forests within the jurisdiction of the states. Major objectives of this program are to protect state and privately-owned forest lands in the state from fire, reduce the amount of forest land burned annually, promote the growth of better quality timber, and increase average annual growth per acre.

The most successful widespread forest conservation effort has been the State Forest Fire Prevention and Suppression Program under the cooperative Clarke-McNary Act and state enabling legislation. At present, all basin counties are cooperating with the state. (See earlier section on: NEEDS). All basin forest land is, therefore, under protection. The average contribution toward this protection by counties totals $1,700 per county annually. Federal contributions under Clarke-McNary are well below the authorized 50/50 matching level. Tennessee's annual costs are around $0.19 per acre protected. Mississippi's costs would probably not vary greatly from this. With this, the normal county complement includes a full-time guard, several seasonal employees, and a 2-ton flatbed or tilt-bed truck with dozer and fireplow, and a half or three-quarter-ton pickup and pumper. Each would be radio equipped.

Detection efforts include towers distributed so as to cover the protected area, and occasionally aircraft provide supplemental detection. Contactors in problem areas of Mississippi and enforcement by guards of fire laws such as Tennessee's 5 o'clock burning law complete the overall Fire Protection Program.

The Tennessee Division of Forestry has a forester available for each five-county area. Mississippi has a forester available in each two-county area. These men work with about 75 landowners each year. Some are repeats, but most are newcomers to forest management. The statewide average for Tennessee is for each forester to give assistance to four or five thousand acres each year. The average size of each individual ownership was 64 acres. Often an annual average will be less than 20 acres per ownership.

Currently, the states are covering about 60 to 65 percent of the total costs of these services. Total costs are about $1.75-$2.00 per acre of land receiving assistance.

In addition to assistance on harvest and sale of forest products, several hundred acres of tree planting are supervised and approvals for Rural Environmental Assistance Program cost-sharing funds are certified. Advice and supervision of timber stand improvement practices is also provided under REAP.

Most PL-566 watershed projects approved for installation include tree planting and other forestry measures. At present, this amounts to one man-year statewide in Tennessee. In the Chickasaw area, a small amount of PL-566 work has been a part of each forester's annual workload. Several watersheds have been operational and have had considerable forestry services supplied. Currently, however, there is very little PL-566 work being done. Most work has been in Mississippi and on two pilot watersheds. Cost levels and cost-sharing are similar to those in the Cooperative Forest Management activity.

Another program operated by the state is tree-planting and tree-seedling production at Tennessee's tree nursery in Madison County, near Jackson, Tennessee. During the years of 1967-68, the nursery produced 17 million seedlings, down from 21 million the previous season. No cost data was available on this program.

Both states are maintaining a statewide watch for forest pest outbreaks. Costs of this program are now centered in areas outside the basin, for no special problems have been identified locally.

Table 6.2 - Summary of State Forestry Programs, Tennessee and Mississippi
Chickasaw-Metropolitan Surface Water Management Survey

	Coverage	Costs	Other
Fire Control	All forest land	$0.19 per acre annually	Includes prevention program and law enforcement
Coop. Forest Management	4-5000 acres per year	$1.75-$2.00 per acre annually	Includes harvesting, timber stand improvements, planting, and other assistance
PL-566 Watersheds	Approved watersheds	$1.75-2.00 per acre annually	Projects now mostly dormant or completed
Forestation-Nurseries	Average 4000 acres per year	Unknown	Includes forest tree improvement program
Insect and Disease Control	All forests	Negligible	Tennessee now has a full-time specialist statewide
ACP Cost Share and FHA Loans	All counties	-	On timber stand improvement and planting
Utilization and Marketing	-	-	No specific projects known within basin

This data includes extensive planting surrounding the area influenced by the Yazoo-Little Tallahatchie projects in North Mississippi. Planting probably does not exceed 2,000 acres annually in the basin.

CONSERVATION BOARDS

Tipton and Shelby Counties, Tennessee, have county conservation boards. These boards were created and authorized to acquire, develop, maintain, and make available to the people of the county public parks, preserves, parkways, playgrounds, recreation centers, county forests, wildlife areas, and other conservation areas; to promote and preserve the health and general welfare of the people; to encourage the orderly development and conservation of natural resources; and to cultivate good citizenship by providing adequate programs of public recreation.

A notable example of the Shelby County Conservation Board's dedication to the aforementioned objectives is the planning and construction of Casper Creek Park. Land for the park has been acquired, a multipurpose dam has been built with storage for recreation and flood control, and construction has started on a complete recreation complex, including a golf course. This park is located in northern Shelby County close to the city of Millington. It was dedicated during ceremonies on May 15, 1970.

Other activities of the Shelby County Conservation Board include acquisition, operation and maintenance of parks and playgrounds within the county. The Shelby County Conservation Board is a prime sponsor of this Chickasaw Metropolitan Surface Water Management Survey.

SOIL CONSERVATION DISTRICTS

Districts are entities of state government and are organized by local referendum under provisions of state law. They are directed by local boards of supervisors in Tennessee, and in Mississippi by local commissioners. They provide local programs of resource planning, development and utilization, and furnish a means for individual citizens and organized groups to participate in the planning, spread, and installation of soil and water conservation practices needed to protect and improve the land, water and related resources.

Soil conservation districts in the Chickasaw Basin have no taxing authority or power of eminent domain. Financing is met by small appropriations by county and state governments and through the support of individual landowners. Districts serve as co-sponsors for all approved watershed projects in the basin. Their responsibility in development of these projects is primarily to carry out the land treatment phase of the work plans. Districts initiate and assist the people in watersheds to organize watershed or drainage districts with authority to acquire land and raise the necessary local funds by special assessments to defray loans on bond issues.

The entire area covered by the Chickasaw study is within organized soil conservation districts. Their programs are carried out with technical assistance furnished by the Soil Conservation Service under memoranda of understanding. Other federal and state agencies participate in carrying out district objectives.

WATERSHED DISTRICTS

Watershed districts in Tennessee and their counterparts in Mississippi, called drainage districts, are special-purpose entities of state government. Their purpose is to develop and execute plans relating to the conservation of water and land resources. This includes the storage of water for floodwater retardation, recreation purposes, municipal and industrial water supplies, control of critical sediment source areas, and an overall improvement in the economic and environmental climate of the watershed community. These districts are administered by directors elected by the owners of lands lying within the watershed.

Districts are usually the primary local sponsoring authority for watershed projects developed under Public Law 566, the Watershed Protection and Flood Prevention Act, as amended. One notable exception to this is Nonconnah Creek Watershed. This watershed is an outgrowth of this basin study and is presently in the planning process. This watershed does not have a watershed district. Instead, it is sponsored by the city of Memphis, Shelby County Court, Shelby County Conservation Board, and the Soil Conservation Districts of Shelby County, Tennessee, and Marshall and DeSoto Counties, Mississippi.

There are only four existing watershed districts within the basin. These are Indian Creek Watershed District in Tennessee, and Grays Creek and Roberson Creek Drainage Districts in Mississippi.

VII. WATER AND RELATED LAND RESOURCE DEVELOPMENT POTENTIAL

This chapter discusses the basin's potential for solving problems, filling the needs for water and related land, agricultural production and recreation. It includes potentials for conserving and improving soils, forests, fish and wildlife habitat, and providing improvements to the environment.

Availability of Land for Potential Agricultural Development

Land available for agricultural use in the future will decrease as non-agricultural land needs and water storage requirements increase. A major metropolitan area exists in the basin and future land needs for urban and industrial expansion, transportation facilities, recreation areas and man-made reservoirs will substantially reduce the land base available for agricultural uses. Based upon present trends and expected economic activity, land available for agricultural production is expected to be reduced approximately 25 percent in the next 50 years. The requirement for non-agricultural land is estimated to be 266,300 acres in 1980; 366,300 acres in 2000 and 503,300 acres in 2020. This will leave 955,600 acres available for agricultural use by 1980; 855,600 acres in 2000 and 718,600 acres in 2020.

An economic analysis of the basin's future use of the land resource suggests that a gradual decline of its use for production of non-wood crops can be expected. Should the need arise, however, the basin has the potential to increase production of crops by 10 percent in the year 2000 without accelerated resource development.

The acreage devoted to each major land use by land capability class is shown in Table 7.1. About 627,000 acres of agricultural land, constituting 63 percent of the basin's agricultural land, is in land capability classes I, II, and III. About 21,259 acres of this amount is in other uses, such as farmsteads and roads, that would not be available for conversion to cropland use. The 129,120 acres of Class IV land is marginal for use as cropland due to excessive slopes, susceptibility to erosion or soil hazards. The use of this land for sustained crop production within the allowable limits of soil loss calls for long rotations such as one-year row crops with three-year grasses and legumes. Not more than 23,000 acres of the class IV land should be in row crops at any one time.

By the year 2000, it is expected that 91,000 acres of classes I, II, III and IV land will be converted to other uses as urban expansion, road construction, and other developments occur. Therefore, 538,000 acres of land suitable for crop production would be available by the year 2000 if needed to meet food and non-wood fiber requirements. This would provide for a conservation program to maintain soil losses within an acceptable level. It would require clearing 144,000 acres of forest and converting 110,000 acres of grassland on classes I, II and III land to crops. Also, an estimated 148,000 acres of land in sub-classes IIw and IIIw have a potential for increased crop production by correction of flooding and poor drainage problems.

About 244,176 acres of land, representing 24 percent of the basin, is in land classes VI and VII and is not suitable for cropland use. Approximately 18 percent of this, now used for crops, needs to be converted to grassland, forest, or wildlife and recreation.

Table 7.1 - Use of inventory acreage by capability class in 1966
Chickasaw-Metropolitan Surface Water Management Survey

Class	Cropland	Pasture	Forest	Other	Total Distribution	
	Acres	Acres	Acres	Acres	Acres	Percent
I	39,816	8,665	15,255	3,376	67,112	6.7
II	202,246	69,182	62,248	13,300	346,976	34.7
III	108,801	32,217	67,116	4,583	212,717	21.3
IV	71,550	27,765	26,165	3,640	129,120	12.9
VI	24,368	23,628	37,658	2,288	87,942	8.8
VII	19,519	32,708	97,158	6,628	156,013	15.6
Total	466,300	194,165	305,600	33,815	999,880	100.0

By cultivating each acre of cropland as intensively as allowable with recommended conservation measures, the basin could increase its present production of non-wood products by approximately 40 percent. By the application of basinwide flood reduction measures, production of crops and pasture could be increased another 10 to 15 percent. It is estimated that, if present land use was held constant except for restoration of flood-plain lands to former productivity, basin crop production could be increased approximately 10 percent.

Land Use and Conservation Treatment

The potential for increasing the rate of conservation treatment and making needed adjustments in land use is affected by economic factors and established customs and patterns of farming. These can be overcome by programs that would include technical assistance, education and information, and effective cost-sharing in application of practices. There are no physical conditions that would restrain or limit land treatment.

It is estimated that an accelerated land treatment program which provided adequate cost-sharing for the treatment of critically eroding areas and technical assistance in planning and application of soil conservation practices, including needed land use conversions, could result in the installation of 75 percent of the treatment needs shown in Table 5.2 and 90 percent of the critical area treatment needs. Such a program could bring about effective land treatment on low income farms where it is estimated that 45 percent of all agricultural land treatment needs and problems occur.

4-30376

Rates of erosion and sedimentation can be sharply reduced by the practice of known conservation measures. The greatest potential for reduction is on cropland where the greatest soil losses occur. The treatment of critically eroding areas could bring further reductions in sediment damages to stream channels, field deposits on crops and pasture, and land voiding.

An indication of the potential reduction of sediment that can accrue by establishing good forest cover is demonstrated in a nearby watershed with soils of the same kind found in the upstream watersheds of this basin. In a study by the Tennessee Valley Authority, the increased infiltration and delayed surface runoff resulting from a change in vegetative cover conditions reduced the annual tonnage of sediment produced. Before treatment the watershed was 23 percent forested, 50 percent idle, 16 percent cultivated and a small remainder was in miscellaneous uses. After treatment it was 33 percent natural forest, 65 percent planted forest and less than 2 percent miscellaneous. The sediment reduction is shown in Table 7.2.

Table 7.2 - Changed sediment production in a watershed converted from 23% forested to 98% forested
Chickasaw-Metropolitan Surface Water Management Survey

Tons of sediment per acre per year	Elapsed time after treatment
24.3	Before treatment
7.6	5 years after
2.2	10 years after
1.1	15 years after

As the table shows, the potential reduction of sediment is about 96 percent on the forested areas and idle land that should be forested.

Extremely high rates of erosion and sedimentation that occur during urbanization and the construction of roads, industry, and housing can be controlled by methods that have proved successful in other urbanizing areas. By the year 2000, about 133,400 acres of land will be transformed into such urban use of which 42,400 acres will be on class VI and VII land. The opportunity exists to require developers and builders to control sediment from erosion during the construction phase. Reestablishment of vegetative cover and its maintenance on all development areas could provide sustained protection against sediment damages to surface water disposal systems. Erosion and sediment control should be an integral part of a community's planning process. Specific control measures will need to be determined by sites and sources. Such measures include diversions, bench terraces, temporary vegetation, grading and construction carried out in stages, permanent vegetation, water stabilization structures, sediment basins, stream channels construction, bank erosion structures, and landscaping utilizing contours.

Land use in both rural and urban areas of the basin can be guided by use of soil survey reports and the stated limitation of various soils. While the general soil map presented as Figure 2.4 of this report indicates broad soil areas, and may serve to caution planners and developers of the general hazards of the areas, the more detailed county soil survey reports can furnish more specific information. The surveys interpret limitations of the various soils in terms of permeability, drainage, flood hazards, and stability for foundations. Information is also included as to suitability for various plants and crops. Engineers find the soil survey information especially valuable in planning for excavation and fill operations.

Water Resource Development Potential

IMPROVEMENT OF HYDROLOGIC CONDITIONS

The existing pattern of land use and soil cover conditions indicates that there is a potential for improving the hydrologic soil cover conditions of the basin. The life expectancy of flood control structures and improved channels and the quality of surface waters in the basin depend largely on proper land management which results in better hydrologic soil cover conditions.

Hydrologic conditions can be improved by the elimination of critically eroding areas in the basin. There is a potential to treat these areas by tree planting or establishing fescue and sericea and converting these areas to grassland. There are many acres of pastureland and hayland in poor condition that, if improved or reestablished, would result in improved hydrologic conditions. There is also a potential for improving the hydrologic conditions of most of the woodland in the basin through improved management and harvesting practices. There is a potential for improving soil cover conditions in areas adjacent to metropolitan areas, such as Memphis.

Increasing the vegetative cover of the basin in combination with conservation practices for water management will increase infiltration characteristics of the soil, interception of rainfall, surface storage and surface detention. Improved land cover conditions and land use changes can have four interrelated, but separable, effects on the hydrology of the basin. These are (1) reductions in peak flow characteristics, (2) reductions in direct runoff, (3) improvement in quality of surface water, and (4) improvements in the hydrologic amenities and stream biota.

The potential for improvement in hydrologic condition of forest land as reflected in flooding reductions is indicated by an analysis of a small 60 percent forested watershed in the central part of the Hatchie Basin just to the north of the upstream area of the Chickasaw study area. Peak discharge from the 10,000-acre watershed was estimated under current land use and hydrologic conditions and compared with estimated peak discharge with unchanged land use, but with forest hydrologic conditions improved to the same level as measured on the well-protected Chickasaw State Forest.

(The Forest Service estimated that improved forest management would change the R/P curve from 70 to 60.) The results show a potential improvement of forest hydrologic conditions sufficient to reduce the flooded area from the annual storm by 50 percent. Flooding from the 10-year frequency storm was reduced by 10 percent. Achieving this potential requires 30 to 50 years of continued protection and good land treatment.

The amount of reduction of runoff and peak discharges depends on the antecedent soil moisture conditions and the intensity of the storm rainfall. Vegetative measures for land treatment are more effective in reducing runoff during a gentle rainfall occurring on relatively dry soil than when an intense rainfall occurs on either a dry or saturated soil. The vegetative cover conditions, while not as effective during intense storms that produce floods of great magnitude, nevertheless play an important role in reducing erosion and thus prevent major sediment damages.

IMPOUNDMENTS

The upper reaches of the Loosahatchie and Wolf River Watersheds and the Nonconnah and Horn Lake Watersheds are well suited for the development of reservoirs. Both the soil and foundation characteristics are favorable for building earth fill structures. Although sand and gravel deposits are found in many locations, seepage is not considered a major problem. Sediment deposition from critical sediment source areas within the drainage basin tends to limit the effective reservoir life unless controlled. Potential storage would allow storage of the average annual runoff of approximately 20 inches, and in a few cases, a storage in excess of 20 inches would be acceptable. Existing fixed improvements such as railroads, highways, and pipelines present problems in otherwise physically suitable sites.

The lower reaches of both the Loosahatchie and Wolf Rivers are not as well suited for impoundments as the upper reaches. Low, rolling topography characterizes these areas, with broad valleys and gently sloping hill lands. The retention reservoir sites available in this area offer an opportunity for floodwater and sediment storage but at the expense of large land areas being inundated with relatively shallow depths. This type of impoundment is generally not acceptable for uses other than flood retention. Deep loess soils in this area are known to be highly erosive, yielding as high as five inches of sediment at many of the available retention sites. Treatment and control of critical sediment source areas above these sites will be necessary to control sediment. Both the soil and foundation characteristics are favorable for building earth fill structures and seepage is seldom a problem.

Potential impoundment sites were identified during field investigation of watersheds. Although watershed projects were not found presently feasible in all of these watersheds, many of the sites show potential for public or private development. Seven watershed projects were found to be presently feasible. These seven projects would involve 1,255 square miles of watershed area or 66 percent of the Chickasaw-Metropolitan Basin. These seven

projects would include 57 flood prevention structures and at least 3 multipurpose structures. The 60 structures would control 22 percent of the area of the 7 watersheds. The 3 multipurpose structures were designed for flood prevention and recreation, offering a total of 2,875 acres of water for water-based recreational activities. Table 7.3 contains additional data on the seven watershed projects found to be presently feasible.

Six other watershed projects were examined in somewhat less depth during the course of the basin study. These projects show potential for development after 1985. The 6 projects would involve 233 square miles of watershed area, or 12 percent of the Chickasaw-Metropolitan Basin. These 6 projects have physical potential for at least 17 reservoir sites. The 17 structures would control 33 percent of the area of the 6 watersheds. Potential watershed projects are shown in Figure 7.1.

Other apparently suitable reservoir sites within these and other watersheds are numerous throughout the basin.

Seven reservoir sites have been identified that would store in excess of 25,000 acre-feet. These sites are well-suited for multiple-purpose uses. Four of these sites are in the Wolf River Subbasin, two being on the main stem and two on major tributaries. Two others are located on major laterals of the Loosahatchie River and one on the main stem. Some of these reservoir sites could store water for pollution abatement, however, the need for such storage was not established.

Five multipurpose reservoir sites were investigated for the Shelby County Conservation Board. The studies were sufficient to establish physical feasibility of the sites for construction of multiple-purpose flood control and recreation impoundments. Two of the sites are located near Cordova; the others are located in the vicinity of Bartlett, Brunswick, and Germantown. These sites would provide about 500 acres of surface water for water-based recreational activities in the urban areas of Shelby County. An engineering report of the investigations for each of the five sites was furnished to the Shelby County Conservation Board. It includes data relative to soils, topography, hydrology, and geology with recommendations for the application of this information in final design and construction. Consult the reservoir sites map, Figure 7.2, for location of sites.

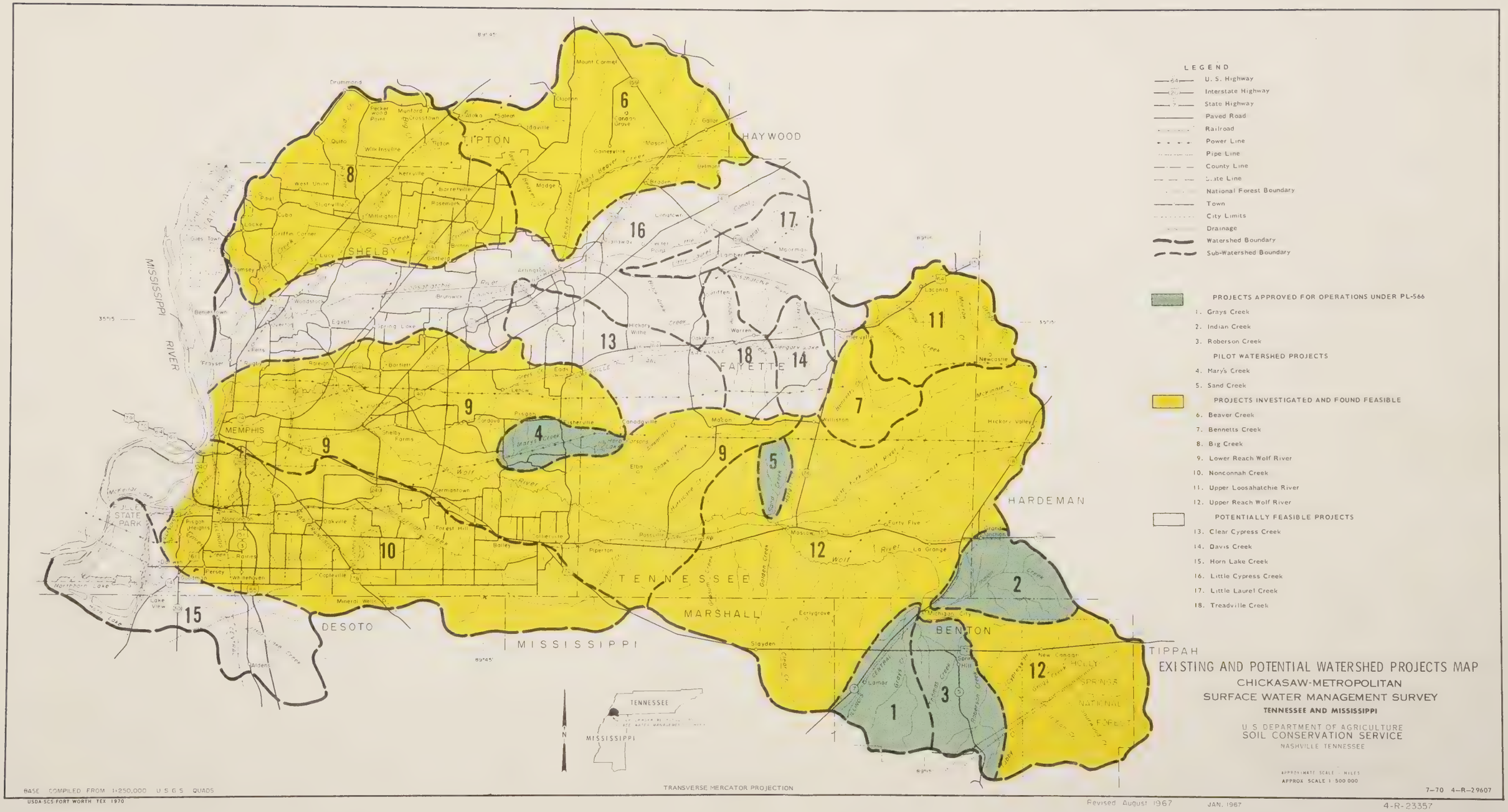
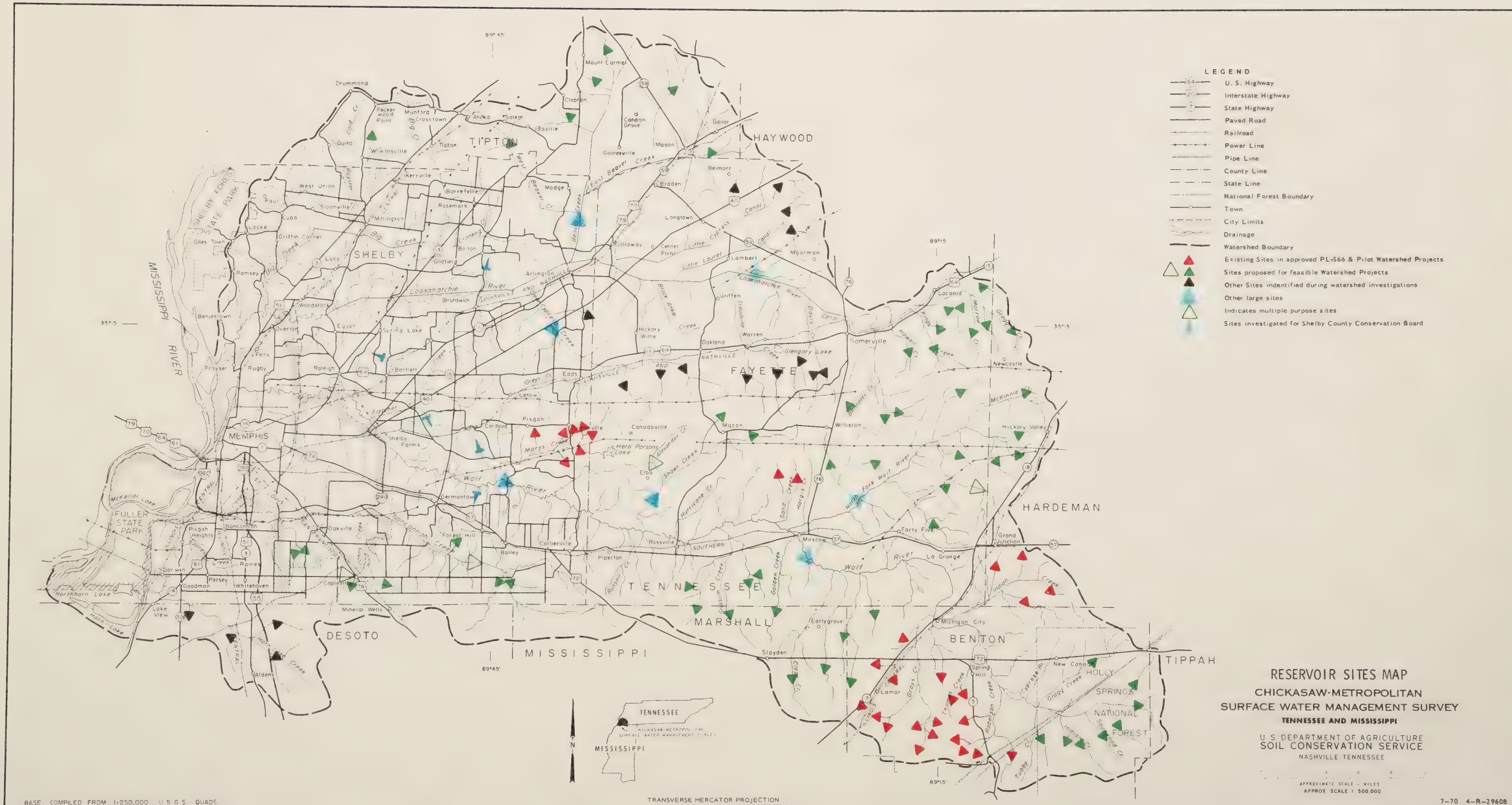

LEGEND
U. S. Highway
Interstate Highway
State Highway
Paved Road
Railroad
Power Line
Pipe Line
County Line
State Line
National Forest Boundary
Town
City Limits
Drainage
Watershed Boundary
Sub-Watershed Boundary
PROJECTS APPROVED FOR OPERATIONS UNDER PL-566
1. Grays Creek
2. Indian Creek
3. Roberson Creek
PILOT WATERSHED PROJECTS
4. Mary's Creek
5. Sand Creek
PROJECTS INVESTIGATED AND FOUND FEASIBLE
6. Beaver Creek
7. Bennetts Creek
8. Big Creek
9. Lower Reach Wolf River
10. Nonconnah Creek
11. Upper Loosahatchie River
12. Upper Reach Wolf River
POTENTIALLY FEASIBLE PROJECTS
13. Clear Cypress Creek
14. Davis Creek
15. Horn Lake Creek
16. Little Cypress Creek
17. Little Laurel Creek
18. Treadville Creek
TIPTON
HAYWOOD
SHELBY
FAYETTE
HARDEMAN
MEMPHIS
TENNESSEE
MARSHALL
BENTON
DESOTO
MISSISSIPPI
TIPPAH
MISSISSIPPI RIVER
TENNESSEE
MISSISSIPPI
EXISTING AND POTENTIAL WATERSHED PROJECTS MAP
CHICKASAW-METROPOLITAN
SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NASHVILLE TENNESSEE
APPROX SCALE 1 500 000
BASE COMPILED FROM 1:250,000 U S G S QUADS
USDA SCS FORT WORTH TEX 1970
TRANSVERSE MERCATOR PROJECTION
Revised August 1967
JAN. 1967
7-70 4-R-29607
4-R-23357

Figure 7.1



USDA-SCS FORT WORTH, TEX 1970

Revised August 1967

JAN. 1967

4-R-23357

FIGURE 7.2

4-30376

Table 7.3 - Information on watershed projects investigated and found feasible
Chickasaw-Metropolitan Surface Water Management Survey

Watershed name and number dam sites proposed	Drainage area (Sq. Mi.)	Storage capacity (acre-feet)					Percent drainage area controlled
		Sediment	Detention	Subtotal flood prev.	Recreation	Total	
Beaver Creek (6 dam sites)	149.2	7,114	10,680	17,794	-	17,794	22
Bennetts Creek (3 dam sites)	28.1	1,347	2,684	4,031	-	4,031	33
Big Creek (1 dam site)	155.1	1,272	1,392	2,664	-	2,664	3
Lower Reach Wolf River (3 dam sites)	300	3.192	6,416	9,608	3,307	12,915	7
Nonconnah Creek (9 dam sites)	183.3	8,826	24,242	33,068	13,178	46,246	41
Upper Loosahatchie River (9 dam sites)	49.1	2,549	7,905	10,454	-	10,454	46
Upper Reach Wolf River (30 dam sites)	390	15,785	32,840	48,625	2,806	51,431	28
Total	1,254.8	40,085	86,159	126,244	19,291	145,535	

CHANNELS FOR FLOOD PREVENTION

Many sand-filled channels in the upstream tributaries can be restored to their original capacities to reduce flood stages and duration of flooding. Channel restoration alone, however, would not provide adequate levels of protection. Channel improvement must be in combination with floodwater retarding reservoirs and an effective erosion control program to justify the expense of construction and maintenance. Sand blocks or plugs deposited at the edge of the bottom lands and in the main stem streams would be removed to provide better outlets for tributary streams. Some of the tributary channels are unstable due to the silty and sandy soil deposits that erode under higher velocities produced during floods.

The meandering channel of Wolf River upstream from Germantown carries only a small part of the flow during flood periods due to sediment plugs and log jams. While enlargement and straightening of the channel would reduce flooding, such improvements would be short-lived unless transportation of sand is halted. Such channel work would increase velocities and stream gradient, increasing bank erosion and transporting even larger amounts of sand to the lower reaches of the river. Channel enlargement would also tend to reduce the considerable flood storage capacity of the wooded flood plains and offset some flood damage reductions gained from the work.

The potential for channel improvement to reduce flooding on Wolf River will not be favorable unless land treatment to control sediment, in combination with sediment basins and floodwater retarding reservoirs, is in effect on the drainage area. Even then, careful design to insure stability of the channel will be necessary. Channel grade stabilizers or even lining of some tributary channels should be considered.

The potential for channel development in the basin will also be governed by the need to mitigate damages to fish and wildlife and the local ecologic conditions. Existing environmental values to be considered include forest tree canopy, waterfowl and small game habitat, and recreational potential.

In many reaches of the smaller tributaries adequate improvements can be limited to removal of fallen trees, logs and sandbars. This approach would have the least cost and the least disturbance to the environment.

DRAINAGE

Most of the soils having limitations due to excessive water problems that interfere with plant growth and cultivation can be improved with artificial drainage or flood prevention programs. It is estimated that 40 percent of all soils that have a limitation problem due to wetness can be improved with a surface drainage system and improved outlets. The Falaya and Collins soils have the greatest potential for improvement by the use of V-drains, W-ditches and land shaping and grading.

It is estimated that all acreage shown as needing drainage in Chapter V has a physical potential for improvement for crop and pasture production and other uses. This includes 47,300 acres of cropland, 22,000 acres of pasture, 7,000 acres other, and 17,000 acres of existing woodland that has a potential of conversion to other uses.

Outlets are generally favorable for installation of farm drainage systems. There is a potential for improvement of sediment-filled tributaries in the upper reaches of Wolf and Loosahatchie Rivers through land treatment to control erosion, sediment control structures, and channel improvements. Economic potentials for complete drainage and water control systems will increase with the increased production of high value crops, improved fertilization and weed control, and the installation of irrigation systems.

GROUND WATER

The aquifers described earlier contain a vast underground reservoir of high quality water sufficient to supply all foreseeable needs in the basin. Present use of underground water is from the 500-foot sand. The 1400-foot aquifer is virtually untapped and is a reserve supply for future needs.

The average daily municipal and industrial water pumpage from wells in Memphis was approximately 180,000,000 gallons per day in 1967; the recorded peak daily pumpage is in excess of 300,000,000 gallons. At the average rate of increase of about 5,000,000 gpd per year, the average daily pumpage for 1968 would be approximately 185,000,000 gpd, and in the year 2000, about 345,000,000 gpd.

Development with proper distribution between well fields and well spacing within the fields can offset lowering of the ground water table from heavy pumping. Foresighted planning by officials of the Memphis Light, Gas, and Water Division has helped reduce the effects of heavy pumping in the Memphis area. Generally, domestic and farm wells do not experience such problems because their spacing is determined by farm or home locations and because of the smaller capacity wells being used.

The right to the use of water in Mississippi, as it relates to underground percolating waters, is based on the common-law doctrine of riparian rights. This law is based on the ownership of land contiguous to a natural water supply. Ownership of land overlying a water-bearing formation is the criterion. Landowners can drill wells and use as much water as they deem necessary, regardless of the effect on surrounding landowners.

The right to the use of underground percolating waters in Tennessee is governed by the reasonable use theory of riparian rights. The reasonable use theory states in essence that the owner of the land beneath which underground waters are percolating shall have the right to such reasonable use of these waters as will not deny or unreasonably interfere with a beneficial use by other owners. In application, "reasonable use" is

determined by a court or jury on the basis of statutory or common law standards. Mississippi and Tennessee are alert to the eventual need for legislation controlling the use of ground water. They have proposed or enacted legislation directed toward the doctrine of prior appropriation; that is, earlier rights have preference over later ones. As an example, the state of Tennessee now requires all users of water in excess of 50,000 gpd to register this use with the Tennessee Division of Water Resources. These data will help eventually in establishing rights of prior appropriation if local problems in ground water usage should evolve.

IRRIGATION

The physical potential for irrigation within the basin is good. Most of the soils will respond to irrigation with increased yields. There appears to be an adequate supply of ground or surface water available for this use. There are about 274,600 acres of existing crop and pasture land with soils and topography suitable for irrigation in the Chickasaw-Metropolitan Basin. There is an additional 40,000 acres of land suitable for irrigation that could be converted to crop or pasture from other uses. The feasibility of using this land to its highest capability is dependent upon the demand for crops that could be produced profitably with good management and irrigation.

Supplemental irrigation has not been utilized to its fullest potential. This has been due to several factors, the most significant of which are (1) high capital investments and operating expenses, (2) lack of technical know-how, and (3) competition has not been keen enough for market prices to warrant a level of management which required irrigation. These factors are changing, however. More investment capital is being brought into the farm management picture. More technical help is available to the irrigator today, and in order to keep his place in the competitive market, the operator must go to higher levels of management. As the average size of farms increases, irrigation becomes more efficient.

Before a farm operator can realize the full potential from irrigation, he must bring the other levels of management to their full potential. He should be using sound methods of fertilization; weed, pest, and disease control; tillage; and sound conservation practices. Adequate water disposal and drainage systems must be installed where required.

The farmer who irrigates, eliminates a large amount of the risk of losses caused by drought. He will have a consistent output year after year. This will be highly attractive to processors, particularly those handling perishable crops. Markets which otherwise would not be available would be open to the irrigator.

WATER QUALITY CONTROL

The potential for improving the quality of water in the surface streams of the basin up to the use classifications adopted by the states cannot be realized without solution to extremely difficult problems of pollution and

contamination. While the physical potential for cleaning up these surface waters is unquestioned, economic restraints are formidable. Tremendous expenditures would be required to provide adequate treatment of municipal sewage. This would require increased local taxes, massive cost-sharing by the states, and substantial federal participation. The cost of treating industrial waste now discharging into the streams would require basic overall changes of industry's cost-profit margin. This can be expected to result in strong opposition which would only be resolved by aggressive and effective public sentiment demanding a better living environment. The public itself, in the long run, must be willing to pay for this improvement.

The relatively low density of population, absence of large cities and scarcity of industrial plants outside of Shelby County, has saved the Loosahatchie and Wolf Rivers from what may otherwise have been a critical pollution problem. Since silt and sediment are the most widespread and damaging forms of pollution, the potential for water quality improvement outside of Shelby County is primarily dependent upon a vigorous program to control soil erosion. The city of Memphis is at present planning two sewage treatment plants, with both primary and secondary treatment and will have them in operation by 1976. These plants along with restrictions on industry are expected to reduce both sewage and industrial pollution of Wolf and Loosahatchie Rivers and Nonconnah Creek within Shelby County.

Operation and maintenance of municipal and industrial sewage treatment plants for the smaller communities outside Shelby County can be improved under guidance of the Tennessee Stream Pollution Control Board. Systematic collection and disposal of garbage offers another opportunity to counties, towns and communities of the basin to prevent stream pollution from solid waste materials.

Agricultural pesticides, herbicides, and chemical fertilizers should be utilized in such a way as to minimize drainage into streams. Conservation practices that increase the intake of water into the soil and reduce the rate and amount of runoff water that reaches the streams can reduce the possibility of pollution from agricultural sources.

The Tennessee Stream Pollution Control Board has the responsibility to investigate all problems concerned with the pollution of the waters and its prevention, abatement, and control and to establish standards of quality for uses of all waters of the state. The water use classification of two of the major streams in the basin has been established by the Tennessee Stream Pollution Control Board and Mississippi Air and Water Pollution Control Commission.

The water use of the Loosahatchie River has not been classified at this time, pending additional study. This stream is the only major stream in the basin that is not an interstate stream. The waters of Horn Lake Creek have not been specifically designated for particular purposes, but until additional studies are made it has been recommended that the waters be used for fish and other aquatic life, livestock watering, and wildlife.

The use of waters in the Wolf River has been divided into two classifications. From the mouth of Wolf River and upstream for 6.7 miles, the waters are classified for fish and other aquatic life. From mile 6.7 through mile 93, the water use of Wolf River has been classified for domestic raw water supply, industrial water supply, fish and other aquatic life, livestock watering and wildlife, recreation, and irrigation. The upper portion of Wolf River in Mississippi has been designated for use as public water supply; however, this does not preclude other water uses for which the stream water will meet minimum water quality criteria.

Nonconnah Creek has also been divided into two segments for the purpose of classifying the use of stream water. The section from the outlet to Winchester Road, a distance of 16.2 miles, has been classified for fish and other aquatic life, livestock watering, and wildlife. The second segment extends from Winchester Road to the headwaters in Fayette County Tennessee. This reach has been classified for fish and other aquatic life, livestock watering, wildlife, and recreation. The headwater reach of Nonconnah Creek in the state of Mississippi has been designated for the purpose of recreation.

Since the use of water in these streams has been designated, and the base parameters established for the quality of water for these purposes, the potential for water quality improvement is primarily dependent upon a vigorous program to control soil erosion, industrial and municipal discharge of waste, and the safe use of agricultural pesticides, herbicides, and chemical fertilizers. Sound conservation practices that increase the intake of water into the soil and reduce the rate and amount of runoff water that reaches the streams can reduce the turbidity of stream water.

Effluent from sand and gravel washing operations, consisting of fine silty and colloidal particles, can be controlled by settling basins or other measures. In several streams this kind of material is the primary pollutant. Local ordinances or regulations may be needed to deal with this problem. It is not too late to reduce pollution in the Chickasaw-Metropolitan Basin and its tributaries so that water quality will meet the requirements for all purposes, including recreation.

Potential for Management of Flood Plain Lands to Prevent Flood Losses

Flood losses in human life, property, and social disruption resulting from improper use of flood-prone lands can be reduced or eliminated by local guidance and regulations to restrict flood plain developments. Opportunities for flood plain management in the Chickasaw-Metropolitan Basin exist along all major streams, but application of management techniques would be most practical where urban or other development has not yet occurred. On Nonconnah Creek, for example, urban development is rapidly progressing to the point that zoning, land use regulation, or other techniques to restrict development would be neither economically nor politically feasible. However, there are large areas of undeveloped flood plain lands along the Wolf

Greenways that provide open space, recreation and wildlife cover may be planned to include utility rights-of-way.

Greenways are being developed along Wolf River. This pine planting is between bridges at Interstate 40 and Highway 70.

4-30376

and Loosahatchie Rivers, now in forest and agricultural use, where management to control development of highly damageable values could prevent millions of dollars in probable future flood losses. Public policy could discourage or prevent construction of any type of developments that would be in the path of future floods. The downstream reaches of these two streams are where urban developments are most likely to occur first.

Since the potential for flood control measures is somewhat limited on the Loosahatchie River, and the broad flood plains near the urbanizing areas of Memphis are subject to imminent development, it appears that flood plain management offers the best hope of preventing flood losses.

Shelby County and the city of Memphis have the opportunity now, before further development takes place, to establish flood plain management policies on the lower reaches of the Wolf and Loosahatchie Rivers. Such management policies could consider the degree of flood control attainable by upstream flood prevention works, the comparative net benefits of protected uses against unprotected uses, and the alternative uses most suitable for each area.

Preventive flood plain management could be achieved through the adoption and implementation of zoning ordinances, subdivision regulations, building codes, and the establishment of encroachment lines, greenbelts, and open space floodways. Flood plain information reports prepared by the Soil Conservation Service during the Chickasaw-Metropolitan Basin Survey provide the necessary data for development of flood plain management systems in Shelby County. In the upstream areas the need for immediate management is not so pressing. However, the Soil Conservation Service can also provide data for guiding land use management in the upstream flood plains.

Recreational Development Potential

The demand for outdoor recreation can be only partially supplied by developments within the Chickasaw Basin. Some residents will continue to travel outside the basin to such relatively nearby reservoirs as Sardis, Arkabutla, Kentucky, Reelfoot and Pickwick Lakes for enjoyment of water-based recreation. Some of the demand can also be supplied by streams like Wolf, Hatchie and Mississippi Rivers. While it is not realistic to propose that total water-based recreation demands can be supplied by developments within the basin, about 15,000 additional water acres can be provided in identified upstream reservoir sites plus new farm ponds.

Reservoir sites in the Upper Wolf River watershed near Moscow, Tennessee, have excellent physical potential for recreational developments. Other watersheds in the basin having potential for water-based recreation developments include Beaver Creek, Shaws Creek, and Nonconnah Creek.

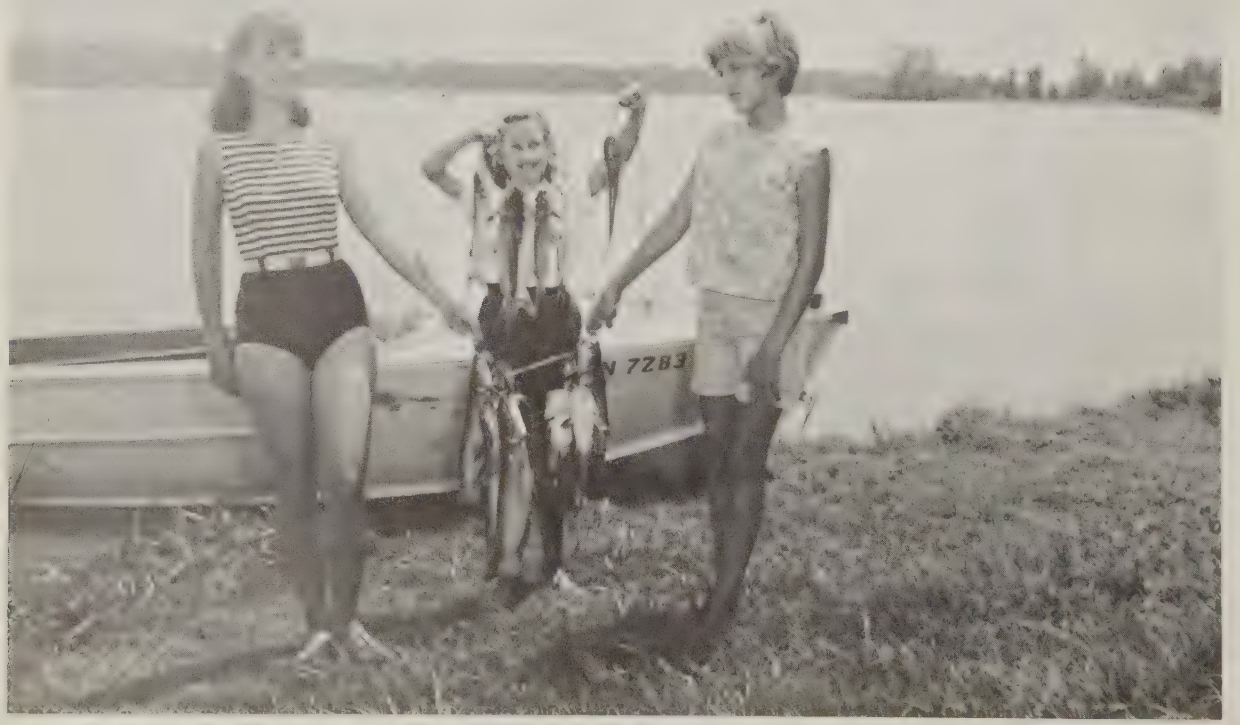
It is estimated that the Chickasaw-Metropolitan Basin has at present a demand of 2,027,300 visitor days of water-oriented recreation that is not being met. Projections indicate that by 1980 this excess demand will

Porters Creek Watershed provides Girl Scouts a recreation lake for canoeing and sailing.

Recreation to suit all ages in the family can be provided at watershed project lakes.

4-30376

These Girl Scouts found that watershed lakes are good for both camping and fishing. Penny Miller, Starr Hatler and Susan Jones display their catch in lower photo.



4-30376

increase to 3,215,100 visitor days. Using a standard value of $1.50 per visitor day, this is a potential annual benefit of $4,823,650.

Hunters from within the basin will likewise have to seek areas outside the basin such as the Hatchie River bottoms and nearby wildlife management areas, but a part of the demand can be supplied by developing and making multiple use of forest and agricultural lands of the basin.

Some of the recreation demand for hunting and fishing can be satisfied by private developments. This would include operation of "put-and-take" shooting preserves, hunting areas, and fish-out ponds as income-producing enterprises. Other potentials exist in organized field hunts for doves, selling of hunting privileges to sportsman clubs and groups, and development of sportsman ranges to include archery, rifle, skeet, and trap.

An excellent physical potential exists for use of the forests along Wolf River between the Shelby County Penal Farm and Moscow, Tennessee. This area includes 35,000 acres of bottom-land hardwoods and could be developed for group campsites, picnic areas, scenic overviews, hiking trails, bridal paths, and waterfowl "green-tree" reservoirs for hunting.

An appraisal of potentials for outdoor recreational development has been completed for each Tennessee county within the basin. These appraisals were made by the Soil Conservation Service in cooperation with the Tennessee Game and Fish Commission, University of Tennessee Agricultural Extension Service, Tennessee Department of Conservation, County Technical Action Panel, and local individuals, organizations and agencies. Potentials for several types of outdoor recreation were appraised as having either a high, medium, or low potential for development. Table 7.4 shows the appraised potential for outdoor recreational activities by counties.

Table 7.4 - Summary of appraisals of potential for outdoor recreation for Tennessee counties of the Chickasaw-Metropolitan Basin

	Fayette	Hardeman	Haywood	Shelby	Tipton
Vacation cabins, cottages and homesites	M	H	M	H	M
Vacation site camping	M	H	M	H	M
Transient camping	M	M	M	M	M
Game, play and target areas	M	M	H	H	H
Picnicking	M	M	H	H	H
Warm water fishing	H	H	H	H	M
Standard and par 3 golfing	L	M	M	H	M
Small game hunting	H	H	M	M	M
Big game hunting	M	H	M	M	M
Waterfowl hunting	M	M	M	M	M
Natural areas	M	M	M	H	M
Scenic areas	M	M	M	H	M
Historic areas	M	M	M	M	M
Shooting preserves	M	M	M	H	H
Vacation farms	M	M	M	M	M
Water sports areas	M	M	M	M	H

H = High potential, M = Medium potential, L = Low potential

Forest Resource Development

The potential for forest resource development in this urbanizing basin is determined in two parts. The first is made up of the regular forestry program elements found in rural areas. The second is the work potential in urban forestry.

The rural part of the survey area consists of the middle and upper portions of the basin, shown as Problem Areas 2 and 3 in Figure 4.1. Maintaining the annual cut of wood products from this area will require management assistance on nearly 70,000 acres annually. However, over 10 percent of this basin's forests are in federal, state, or corporate ownership. In addition, about 5,000 acres per year are now receiving adequate management assistance. This leaves about 50,000 acres subject to annual harvesting in some degree without technical guidance.

In addition there is an estimated potential of 35,000 acres of tree planting to heal critical or gullied areas and to make productive the idle or poorly stocked forest land. This amounts to an annual planting goal of 2,300 acres per year for the 15-year initial period. The potential for changing forest species to other species by type conversion is about 5,700 acres, requiring no change in the rate of current activity.

The greatest potential for development of forest resources would be timber stand improvement measures on about 170,000 acres.

Protection of 51,700 acres of forest from damages by livestock as part of the overall management program and reducing fire losses from an average annual burn of 600 acres to a maximum of 460 acres completes the potential forestry development in the rural areas of the basin.

There is a potential for improving the soils ability to support tree growth through improved nutrient levels. Researchers in forest soils in this area of the south have found that climatic conditions at the soil surface (microclimate) lead to rapid decomposition of organic matter with high rates of soil nitrogen usage. Forests in poor condition often produce less organic matter and certainly those grazed or burned are lower in their production. Couple this with less shade, compacted soils, and sterilization of the soil surface from hot fires and the rebuilding rate of the unprotected forest soil is inadequate.

Protection of the soil surface from fire, the trampling effect of livestock, the direct heat of the sun, and the direct impact of severely erosive rainfall can result in rebuilding a normal and well-developed forest soil. To provide the needed nitrogen in forest soils, it is not now practical to use commercial fertilizers. However, certain tree species can be selected that provide litter high in available nitrogen. One of these successfully planted in this area is loblolly pine. Many of the native pines are also high in soil-building nitrogen. Other species that aid in soil building can also be favored. The broadleaf species found in this area have very low nitrogen-producing leaf and twig litter. There are studies that report an increase of three times as much nitrogen accumulated after conversion from brushy or weedy cover to pine. For this reason, management of the tree species can be important in improving the potential of these soils. Once rebuilt, the hardwoods could again be favored if markets were favorable.

In addition to improving the productive capacity of the soil, increasing the growing stock to the potential of the site has the possibility of increasing greatly the allowable cut. Building up the growing stock increases the base volume upon which new wood can build up. Projections indicate that, at the current ratio of growth to cut (5.9 percent growth: 4.2 percent of cut), the full potential of all sites fully stocked would not be reached until 2050.

In Figure 7.3, the upward slope of the projected possible cut reflects a continued increase of total growing stock.

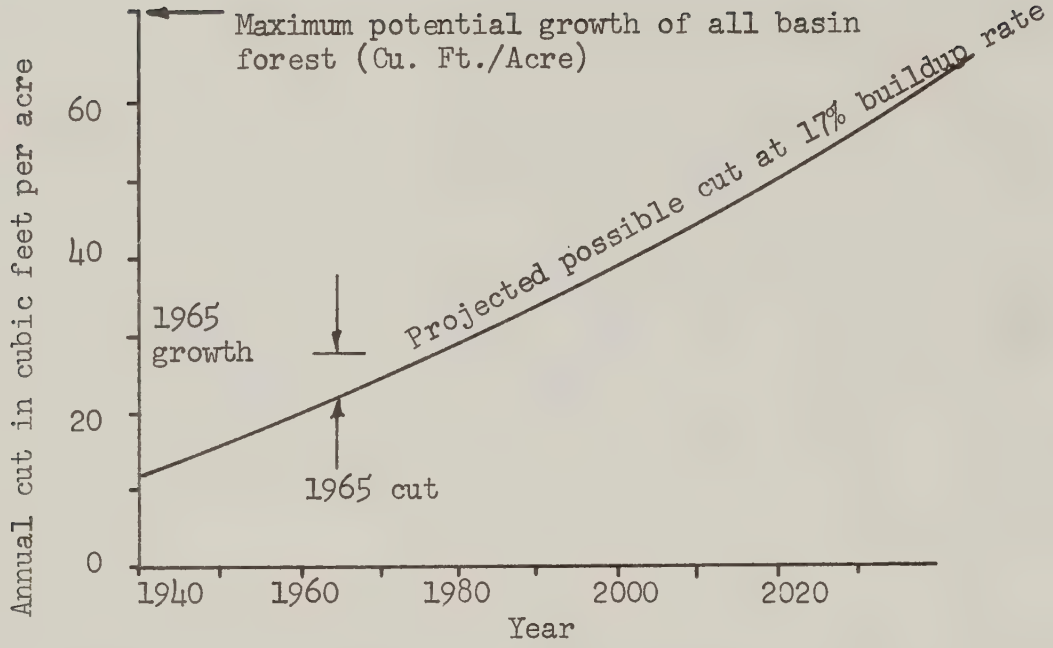


Figure 7.3 - Potential volume of growing stock available for sustained annual cutting by years--Chickasaw-Metropolitan Basin

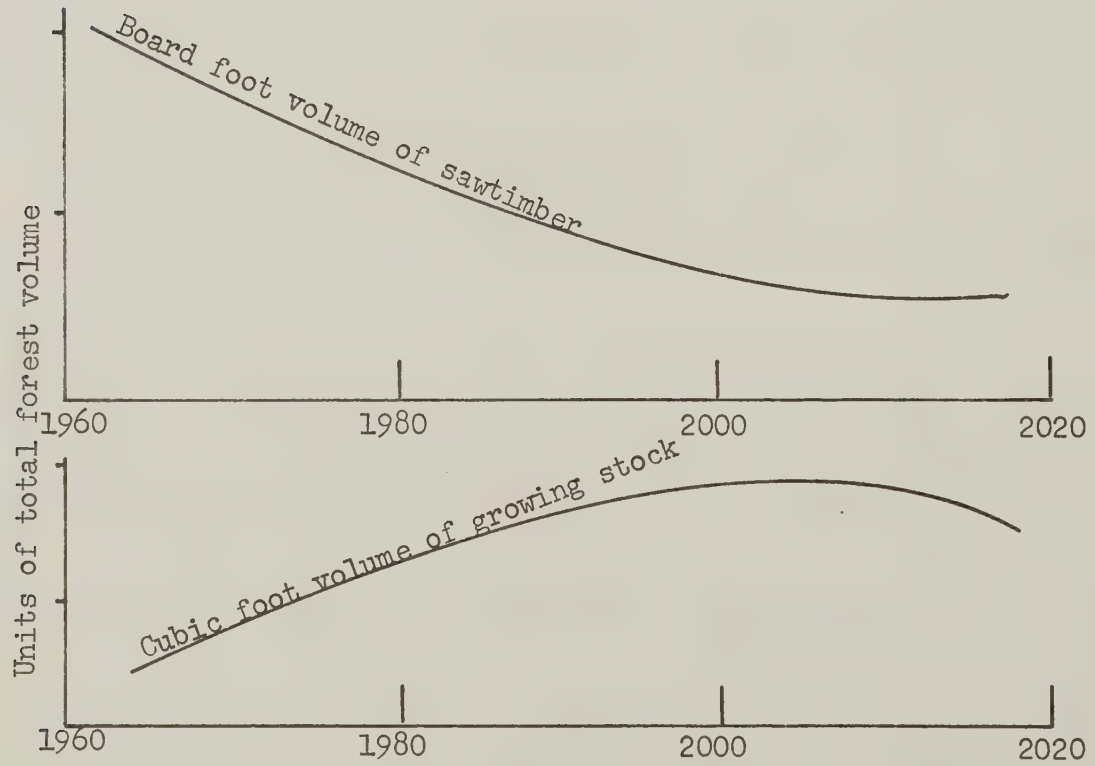


Figure 7.4 - Projected forest volumes West Tennessee and North Mississippi

4-30376

Southern Forest Experiment Station projections of growing stock buildup show substantial increases of growing stock in softwoods and hardwoods to the year 2000, then a decline. Projections of the larger sizes (sawtimber volumes) are declining now and continue until 2020 when they begin to level off at about one-third the present level (See Figure 7.4).

These trends in Figure 7.4 indicate that the projected buildup rate of growing stock is destined to change and become a depletion (cut in excess of growth) around the year 2000. This is already true in the sawtimber category. It is an indication of excessive cutting in the larger size trees and less pressure for the smallest sizes. This in effect depresses the potential growth level.

Coupled with the economic predictions of industrial growth and the demand for cordwood, both sawtimber and cordwood users will face a shortage. With management, about two-thirds of the potential will be reached by 2020. In 1965, cut was 19.5 cubic feet per acre basinwide. Without allowing for buildup, the potential figure with applied management could be 48 cubic feet per acre while still leaving a 17 percent margin for buildup. This is the volume potential. It could result in more than doubling the per acre dollar returns in annual income to forest owners.

It will take 20-30 years for production rates to increase even if good management practices become universally used immediately. This is sufficient time for technological changes to take place in wood-using industries. For this reason, no alteration is expected in the projected decline in employment. On the contrary, if the improved productivity of these forests through management is not achieved, the decline in employment levels may be greater.

The best forest soil association is in the bottom land where well adapted species occur on soils with generally good water conditions for growth. Where not covered by coarse sediments, these sites can grow in excess of 600 board-feet per acre per year.

Wetter sites or those still affected by excessive sediment may only be capable of 400 board-feet annually. The deeper second bottom or reasonably level upland soils also have a 400 board-foot annual potential; however, these are usually cleared for crops. Other upland soils not excessively eroded have a 200 to 300 board-foot per acre annual potential.

Most of the coastal plain type upland soils, on steep slopes or narrow ridges with historically eroded surfaces have little potential for tree growth. These drouthy sites, often with a hardpan (fragipan) restrictive layer, can produce 100 board-feet in hardwoods or 200 board-feet annually in pines. Combined with the suspicion that the microclimate is so harsh that hardwoods cannot maintain the needed nitrogen levels, these sites leave little alternative to pine management for full utility and protection of the forest and soil.

The second potential activity category is work to be done in urban forestry on Problem Area 1 shown in Figure 4.1. As the city grows, it moves onto once-farmed level and rolling agricultural land where timbered areas are scattered and in badly abused condition, contributing little more than esthetic desirability in an urbanizing environment.

Although wooded areas are only a small part of the total landscape, the potential for slowing overland flows and trapping the waterborne sediment is high. Woodland conditions are being replaced by compacted earth and lawns, roofs and pavement, thus speeding surface water runoff, reducing infiltration and resulting in higher flooding potentials.

Using land in urbanizing areas for forest products activity is unrealistic. Wooded areas remaining will be for esthetic purposes such as screens between noisy highways, airports, or industry and adjacent areas of homes. Forested land will serve recreation as sites for parks and greenways. Present timber types and conditions are not particularly good for any of these uses, but thoughtful planning could develop the potentials of the vegetation that is now growing.

Lack of control over the nature of land development is rapidly depleting those areas that could be developed for future woodland uses. There is a potential in strong zoning efforts to keep woodland, homes, commercial and industrial uses in the areas and on the sites where they are compatible with their needs as well as the communities needs. Lands that should be in these various uses can be identified. In every sense, it is as urgent to manage the growth of the city into the upland as it is to manage the flood plain. Only through guidance and leadership by the public planners can the long-range problems be, in some measure, circumvented. A simple example of lack of control is the continual allowance of persons to develop the flood plain.

Land treatment opportunities in an urbanizing area become elusive, especially when the programs and experience are rurally-oriented. Forestry measures are even less obvious when only five percent of the area is forest. There are three major potentials: Soil development, soil protection, and water yield or flow manipulation. The first two are reflected in erosion considerations.

Soil development includes gully stabilization (critical areas) road and trail stabilization, woodland terracing, forested streambank stabilization and rehabilitation for forest cover (stand improvement, type conversion, and forestation). Application of these to our urban area is easily overlooked. In addition, little has been done to evaluate the effects on times of concentration and trapping of sediment that retaining and properly managing zones of woodland can effect. Nonetheless, these zones can be identified, located, and their treatment prescribed. This treatment should use the effects of all of the soil development measures.

Soil protection measures are more easily identified. Normally included are protective measures against wild fire and uncontrolled livestock. Neither of these are great threats in the urban area. However, efforts to maintain a public awareness of their responsibility to protect against accidental fires would be needed if forest soil development measures are undertaken. In urban areas, uncontrolled recreation use can create damages not unlike uncontrolled livestock. Motorbikes cut uncontrolled trails, resulting in gullying; picnickers can trample and destroy needed litter producing understory vegetation; and streambanks can be denuded by boaters and fishermen when pressures of the population are excessive. There is a substantial potential workload for protection of the improving environment.

Water yield or flow manipulation is a subtle change that is equally as elusive as soil development. Lengthening of times of concentration was previously mentioned. Here it becomes paramount. Improved infiltration is equally demanded if contributions toward flood protection from forestry activities are to be accomplished. As mentioned in basin problems, these soils may percolate water quite well, but not proportionately as quickly as the intensive rainfalls would require. When shooting for a 100-year flood protection, with the given soils and a very low percentage of true forest cover, the potential to effect changes on stage discharges through improved forest soil infiltration is seriously limited.

The opportunity to retard overland flow, even in the 100-year storm is greater. The resulting lengthening of the time of concentration could materially reduce the damaging flood stages. This would require placement of effective width zones of well developed woodland across the path of concentrated overland flow coming from urbanized areas. These zones could serve multiple purposes as sound and esthetic view screens, as recreation accessways and as park areas themselves. They would trap sediment and slow surface flow of water.

Structural Measures: In the construction of recreation and flood protection reservoirs, these above mentioned potentials for land treatments should be considered, specifically adjacent to the conservation pool. Also, in the upstream areas serving to supply the water, there should be intensive efforts to reduce the erosion and sediment transport to prolong the life as well as improve the water quality in the lakes.

Flood Plain Management: Greenways are being considered for the area along the main stem. These would be partially forested and usable for recreation. Regardless of the width and method of development, there should be no difficulty in establishing tree species compatible with the occasional flooding and continual recreation use of such areas. There is also a potential beyond these greenways upward into the tributaries and into the uplands where intensive urbanization should take place.

Land Utilization Potentials: Land values leave little doubt that land in the city will not be suited to timber production. There is sufficient

opportunity to provide for the forest-based industries from other parts of this basin or from other basins.

There is, however, considerable potential for forested land interspersed with the urban uses. Projections show forest cover reducing eventually to one acre in a hundred. This is vastly inadequate to meet the esthetic and recreational needs of a pleasant and healthy community.

Land values are enhanced in wooded communities. Additional wooded lands could accomplish the water and related land treatment needs previously discussed.

Placement of parks where they are accessible to every youngster in the community - in walking distance - would require a 10-acre park in every square mile. Well planned communities throughout the nation are planning such development. A portion of these would be tree shaded. These wooded areas, if thoughtfully located, could serve many of the needs discussed here. Other distribution of land uses should receive careful consideration in light of the erosion, runoff and flooding characteristics of the area.

Forest resources of the urban area are vastly inadequate. Their distribution has been left to chance and, as a result, they are not contributing to the community in the form they could.

As an example, Days Creek, fully urbanized in the lower reaches of the Nonconnah Subbasin, has no developed woodland. There are some patches of trees in two places along stream banks. These do not intercept overland flow nor do they provide accessways to recreation facilities. They provide no screening from the interstate highway or the extensive warehouse and industrial areas.

By contrast, the adjacent Hurricane Creek which drains the International Airport is still 14 percent forested, but its forests are losing ground rapidly. Soon, all screening of noise and activity at the airport will be lost as homes and commercial development clear away the trees. Also, some excellent day-use recreation sites will be lost and runoff and sediment will be markedly increased.

The other tributaries range from seven to ten percent wooded at present. As development proceeds, they will eventually look like Days Creek with a few scrubby trees in little unusable patches on odd pieces of land along the stream banks. This is, unless the city acts to provide for a greater contribution to the beauty and desirability of the community from what wooded areas remain. Other community needs could be met through a program of tree planting, using selected species that would provide shade (hardwoods) and soil protection and runoff retardation (pines) where needed. In such a program the distribution of wooded areas could be influenced to the extent required.

Forested or naturally vegetated areas can be located where they would serve as screens, noise shields, and as waterway protection and sediment traps. This distribution could raise the open space (forested and other) to 20 or 25 percent from the currently projected one percent.

Planted pines in the roadside screen out highway noise and activity from residences nearby. Highway travelers experience a rural view even in metropolitan areas.

The potential runoff from storms as this area urbanizes is quite high. A substantial increase in open space and natural forest conditions can provide areas where greater infiltration and delayed overland flow will occur. An increase in infiltration and delay in the timing of water reaching the streams can be expected to reduce the peak flows that result in flooding. The greater the use of forest-like conditions, the greater is the potential for such reductions.

The increased infiltration and reduced overland flow velocity that occurs when the runoff flows through woodland would, except for the severest of storms, trap the sediment that comes from the urbanization process. Placement of woodland strips on the contour downhill from construction sites can greatly improve the quality of water reaching the streams. In areas of steeper sloping land, wider or more numerous strips might be needed.

4-30376

Small game hunting is a favorite sport in the basin. Better management could increase these opportunities.

The basin is good country for quail and dove hunting.

4-30376

Woodland along stream banks are essentially interceptors of the runoff as well. In this way, surface flow would be forced to run through a wooded strip before reaching the streams. Peak discharges and sediment loads could both be materially reduced. Other benefits in the form of esthetically desirable surroundings, noise abatement, and readily accessible recreation areas would be added.

Fish and Wildlife Development

Rapidly increasing population and urban expansion which bring problems of pollution, more intensive land use, and a changed ecology, limit the potential for development of fish and wildlife resources in the basin. The development of reservoirs throughout the basin offers the best opportunity for improving fish and waterfowl habitat. Upper reaches of the major streams can be improved for fishing by reduction of silt pollution and development of better access. Some of the larger reservoir sites have potential for waterfowl habitat development. Green-tree reservoirs with low levees and water control devices could be developed along the Wolf and Loosahatchie Rivers.

Practically the entire basin, other than the heavy urbanized area, is adaptable to small game management that includes dove, quail, rabbits and squirrels. There is a big demand for small game hunting areas near Memphis. The basin is recognized as good quail country with the National Bird Dog Field Trials being held annually on the Ames Plantation near Grand Junction, Tennessee. Good management of farm land and application of sound conservation practices will help improve the habitat and cover for most of the basin's small game.

Fish farming has a potential for development in the basin. The abundant supply of ground water and the relatively flat terrain makes this type of development feasible. Higher water temperatures from deep aquifers are a special asset for growing catfish.

VIII. COMPREHENSIVE PLAN OF DEVELOPMENT

This chapter presents a comprehensive long-range plan for development of water and related land resources in the Chickasaw-Metropolitan Basin. It describes how the major elements of the plan can be carried out under existing agency authorities. Two alternatives are proposed for implementing the basin plan, each involving different levels of costs and accomplishments. USDA program costs are compared for each alternative.

Plan Formulation

PLANNING CONSIDERATIONS

The well-being of people and the kind of environment in which they will live were major considerations in formulating a comprehensive basin plan for development of water, land, and related resources. The developments are aimed at reducing economic losses due to floods, erosion, and sediment. They are intended to provide better economic opportunities through more efficient use of resources. More opportunity for outdoor recreation, cleaner water in the surface streams, and improved appearance of the landscape would enhance the environmental quality of the basin.

The comprehensive plan was developed after making an inventory of the water and related land resources of the basin. The inventory included a study of resource problems, needs, and potential for development. The kinds, amounts, and conditions of the resources were studied in relation to the overall environmental quality of the basin.

The original objectives of the Chickasaw-Metropolitan Surface Water Management Survey were reviewed to determine if additional objectives may have been brought to light in the course of the study. It was concluded that the improvement of environmental quality, not specifically spelled out as an original objective, should be added as an inherent objective of the survey and included as a part of the comprehensive plan.

A major consideration throughout the process of plan formulation was to identify a combination of developments that would harmonize the needs and desires of different interests in the basin. There are no basic conflicts of interest between upstream rural landowners and downstream urban people, although their immediate objectives in water resource development may differ in some respects. Both have flood problems. Rural people need protection against agricultural damages on flood-prone land; urban people need protection against damage to homes, churches, schools, commercial and industrial installations, parks, roads, streets and public utilities. Flood protection that provides immediate benefits to upstream rural residents contributes to protection of downstream urban values.

Erosion control measures with costs mainly borne by upstream landowners benefit both upstream and downstream people by reduction of sediment damages and abatement of stream pollution. Demands for outdoor recreation

by both urban and rural residents must be supplied in rural areas. It is clear that the welfare of both rural and urban elements of the population is bound inseparably to the wise use and development of the existing water and land resources.

Full support by both upstream rural people and downstream urban interests in the Chickasaw Basin will be required to bring about natural resource developments for satisfaction of the human needs of the greatest number of people - their safety, health, welfare and opportunity to enjoy a pleasant environment.

The satisfaction of water resources needs cannot (of itself), insure attainment of economic developmental goals, but failure to eliminate known deterrents to private investment such as flooding, erosion, and sediment pollution, as promptly as possible will result in the foregoing of opportunities for better utilization of the presently under-used labor force, and for obtaining maximum economic advantages in the area.

The current and past rate of watershed development, land treatment and other natural resource development was studied in relation to future needs. These rates of accomplishment under existing programs were found to fall far short of meeting the objectives and time requirements. For example, only 21 percent of the needed cropland treatment in the Chickasaw Basin has been applied, and only 15 percent of the needed grassland and forest treatment has been applied. Only five small watersheds, representing 7 percent of the basin area, have been completed, or are in process of development, while investigations revealed seven additional watersheds, comprising 66 percent of the basin area, are feasible and need development as early as possible.

While the critical need for restricting development in the flood-prone lands along the lower reaches of the major streams has been recognized, no effective flood-plain management programs or policies have been adopted by local government. One reason for this has been the lack of accurate flood elevation data and identification of affected lands. The only element of control that has been exercised in the past has been by the Memphis City Engineer's Office in restricting building elevations. While this approach is commendable, it has not been as effective as formal regulations by county or city government would be. Flood plain information reports were prepared as a part of the study on Nonconnah Creek and the Shelby County reaches of the Wolf and Loosahatchie Rivers. These provide the basic information necessary to local government to establish a flood-plain management program.

COORDINATION WITH OTHER AGENCIES

The study was conducted by the U. S. Department of Agriculture in coordination with concerned local, state, and federal agencies. The survey was sponsored by the Tennessee Department of Conservation, the Shelby County Conservation Board, the Shelby County Soil Conservation District, and

the Mississippi Board of Water Commissioners. Each state and federal agency having interests in the basin was notified that a comprehensive study was being undertaken. Each was requested to make any contribution that would help in the development of the water and related land resources of the basin.

A Chickasaw Advisory Committee was formed consisting of representatives from county governments, planning commissions, county conservation boards, soil conservation districts, watershed districts, USDA agricultural agencies, state agencies and local groups and organizations in the basin. This group met periodically throughout the course of the study to consider problems encountered and progress made. It provided a valuable means for full and continuing exchange of views during the study.

The survey staff maintained close liaison with the Shelby County Conservation Board and its consultant throughout the course of the study. Staff members also met from time to time with soil conservation district boards to keep them informed on progress of the survey. The Memphis and Shelby County Planning Commission furnished valuable information and advice related to the Memphis urban areas, including future growth projections.

At the request of the U. S. Department of Agriculture, an ad hoc biology work group compiled data on needs and potential for fish and wildlife development. Representatives of the Bureau of Sport Fisheries and Wildlife, Corps of Engineers, Tennessee Game and Fish Commission and Mississippi Game and Fish Commission participated with Soil Conservation Service biologists in preparation of an informal report. The report was used as supporting data in plan formulation.

The Bureau of Outdoor Recreation prepared a preliminary report of recreation needs, supply, and demand for the combined Chickasaw-Metropolitan and Hatchie River Basin area. This report and the Tennessee Statewide Comprehensive Outdoor Recreation Plan supplied by the Tennessee Department of Conservation were used in program development.

OTHER PROGRAMS EVALUATED

In the Wolf River Subbasin, five independent tributary watersheds were studied to determine their physical and economic feasibility and their effectiveness in meeting objectives of the study. These were North Fork Wolf River, Shaws Creek, Grissum Creek, Five Creeks Watersheds and Upper Wolf River Watershed. This approach did not provide a comprehensive plan for land treatment of all the Wolf River drainage area, nor did it provide for channel rehabilitation to supply needed outlets. Only half of the drainage area would have been covered by the projects. This led to the conclusion that the whole Wolf River drainage area should be combined into two large watershed projects, excluding only the areas covered by existing or planned watershed projects. Evaluations of these two watersheds, Upper Reach Wolf River and Lower Reach Wolf River, indicated their physical and economic feasibility. All of the Wolf River drainage area would thus be

provided with benefits of land treatment, including control of erosion and sediment, flood protection and improved outlets. Flooding on the main stem would be reduced to a frequency of once in three years during the crop growing season. Assuming that a 1500-foot floodway is set aside in the Shelby County reach, flood peaks would be reduced by an average of 1.5 feet.

A second program which would include watershed projects on both the Upper and Lower Reach Wolf River, plus three large dams, was evaluated for effects on flooding. One dam would be located near the mouth of Shaw's Creek, one on the North Fork of Wolf River near Moscow, and one south of Moscow on the Wolf River main stem. This second alternative would require a larger channel for Wolf River than is proposed for the basic program, essentially a channel that would match the size of the existing channel as improved up to Gray's Creek. This program with three reservoirs combined with the basic program of watershed projects would give a 100-year level of protection downstream from Moscow to about the Shelby County line, and a 25-year level of protection throughout the Shelby County reach. Peak flood stages in a 1500-foot floodway through Shelby County would be reduced 2.5 feet for a total of 4 feet, including the reductions previously gained by step one.

A third program evaluated was predicated on prior establishment of both the above programs. It would provide for a large dam on Wolf River near the mouth of Gray's Creek. Such a dam could provide storage for flood control and recreation purposes. This dam, in combination with both programs called for above, could provide protection against a 100-year flood in the downstream reach of Wolf River until it meets the backwater from the Mississippi River. It would allow containment of the 100-year flood within the existing improved channel of Wolf River.

Economic feasibility of these latter two programs was not determined inasmuch as the design and costs for the dams is outside the scope of this study. Additional studies would be required to determine economic feasibility and could include other objectives besides flood control.

Plans for the Loosahatchie River Subbasin call for development of four watershed projects, but no works of improvement on the main stem. Five alternative programs were evaluated for the control of flooding on the Loosahatchie River main stem. Program formulation and evaluations were based on protection of agricultural land without urban development for the next 15 years. Past improvements to the Loosahatchie Channel combined with a low frequency of flooding during the crop season results in a fairly low average annual damage estimated as $205,000. Frequency of flooding was determined from the Brunswick stream gaging station. The results of these evaluations are presented in Table 8.1. It is notable that none of the developments provided benefits to the main stem in excess of the costs. However, development of the four watersheds is justified based on benefits accruing within the watersheds. The development of these watersheds would have only a minor effect on main stem flooding.

4-30376

Table 8.1 - Estimated effects, costs, and benefits of five alternative developments on Loosahatchie River main stem flooding - Chickasaw-Metropolitan Surface Water Management Survey

Alternative developments	Floodwater average annual damages remaining	Benefits from floodwater damage reduction	Percent reduction of flooding	Net annual benefits	Estimated annual cost 1/	Benefit/cost ratio
Present conditions, no development	$205,000	-	-	-	-	-
Four watershed projects on tributaries	189,200	$15,800 2/	7.7	(not determined for main stem)		
Four watershed projects and channel improvement on main channel	74,800	130,200	63.5	$114,400	$437,000	0.26/1
Watershed projects and four intermediate size structures	156,400	48,600	23.7	32,800	215,000	0.15/1
Four watershed projects Four intermediate structures and channel improvement on main channel	54,500	150,500	74.4	101,900	537,600	0.19/1
Large dams on Beaver Creek and main stem of Loosahatchie with watershed projects and intermediate size structures	71,900	133,100	64.9	84,500	(not determined)	

1/ Annual costs are based on 5-1/8% interest and on a 100-year evaluation period.

2/ Benefits to main stem attributed to watershed projects on tributaries.

The Long-Range Comprehensive Plan

GENERAL DESCRIPTION

The proposed plan provides for the conservation, development and use of water and related land resources of the Chickasaw-Metropolitan Basin in the best interests of the people now and in future years. Basic elements of the plan consist of (1) land use and conservation treatment of rural and urban land to be installed by landowners, with some measures eligible for federal cost-sharing, (2) development of watershed projects to prevent floods, and provide water storage for recreation, fish and wildlife, and other purposes, (3) management of flood plain land use to control and reduce flood losses on private and public land, (4) development of outdoor recreation facilities to meet demands of the growing population, and (5) improvement of the environmental quality of the basin. The development elements selected are mutually supportive, compatible with each other and satisfy one or more of the survey objectives. The plan offers solutions to the most pressing current resource problems while providing for development, use and management of the basin resources to sustain future growth. The overall plan provides major improvements to the environmental quality of the basin.

All elements of the comprehensive plan would interact to strengthen each other. For example, land treatment required in watershed project development controls erosion and abates agricultural related pollutants, including sediment, while reducing surface runoff that contributes to flooding. The control of erosion and silt and the abatement of pollutants would enhance recreational values and fish and wildlife habitat. Watershed project and greenway developments would provide recreational facilities and improve environmental qualities within the basin.

The beneficial effects of the total plan would, therefore, be greater than the sum of the effects of the separate elements. For these reasons, it is recommended that the comprehensive plan be installed concurrently as an integrated system in order to maximize benefits.

LAND USE AND CONSERVATION TREATMENT

The comprehensive plan of development calls for planning the use and conservation treatment of the basin's land resources as an important element of sound resource management. While investment in human resources and capital facilities is important, the development of natural resources is the basic building block in strengthening the economic base and long-term growth of the region. In the Chickasaw-Metropolitan Basin, the foundations for economic growth can be broadened and strengthened by development and conservation of water, land, fish and wildlife resources and the enhancement of outdoor recreation opportunities.

Contour farming would be practiced on fields having uniform topography.

No-till planting facilitates use of multi-row equipment, is economical, and is gaining favor as a conservation measure.

4-30376

The program will require treatment of all the land in the basin not already adequately treated. This presently includes 366,100 acres of cropland, 165,200 acres of grassland, 260,000 acres of forest land and 22,400 acres of miscellaneous land. Critical area treatment will be completed on 183,400 acres. This includes gully stabilization structures, shaping and seeding of gullies and ditches, and roadbank stabilization. It also includes 100,000 acres severe sheet erosion on cropland.

The plan provides for acceleration of conventional land treatment programs on the rural lands of the basin; conservation and sediment control treatment of urban lands and land in the process of development for urban uses; and a cost-sharing program to accelerate treatment of critically-eroding sediment-producing ares. The program includes complete conservation plans for individual landowners, communities, institutions, and other groups. Land use adjustments will be made based upon using each acre of land within its capability. Land treatment measures will be applied with the objective of reducing erosion to the allowable soil loss tolerance. Land treatment will provide for reduction of the rate and amount of rainfall runoff and thereby improve the quality of surface water in the basin. In the development of conservation plans, consideration will be given to land use changes that provide more efficiency in production and contribute to improvement of economic conditions.

Urban land treatment would consist of the eatablishment of permanent vegetation on home sites, vacant lots, public property, and other open lands. It would include the establishment and maintenance of greenbelts for such purposes as sound screens, esthetic screens, recreational and park areas, water control, and sediment traps. It is essential during the urbanizing process that developers and property owners minimize erosion and sedimentation during construction operations.

Assistance in development of conservation plans and application of land treatment measures will be provided for about 3,600 acres of land disturbed during construction operations each year. Guidelines will be developed to assist local government in formulating regulations to control sediment, flood plain development, erosion and runoff. Developers will be furnished information, advice and counsel to assist in control of sediment and erosion and to aid in selection of land use. In addition special assistance in the application of forestry techniques in the urban areas will be provided.

Some irrigation would be practiced on the better drained flood-plain land and the flatter uplands of the basin. Approximately 2,000 acres of fruit and vegetables, nurseries, cotton, and some corn would be irrigated. A problem of water supply could develop during peak irrigation periods along smaller tributaries while several systems use the water from streams. It is expected that much of the water would come from wells in the event of a major expansion in irrigation. The water withdrawal from wells for irrigation would have very little effect on the supply of available ground water.

DEVELOPMENT OF WATERSHEDS

It is proposed that thirteen additional watershed projects be developed so that all major and most of the minor tributaries of the Chickasaw Basin would be included in watershed projects. These projects would reduce flood damages and provide water storage for recreation, fish and wildlife, pollution abatement, irrigation and municipal or industrial water supply consistant with the objectives of local sponsoring organizations. Land treatment to control erosion and resulting sedimentation would be the foremost consideration in watershed project development. Approximately 78 reservoirs and 280 miles of channel improvement will be required. The thirteen watersheds cover 1488 square miles or 78 percent of the total basin area. They are Beaver Creek, Bennetts Creek, Big Creek, Lower Reach Wolf River, Nonconnah Creek, Upper Loosahatchie River, Upper Reach Wolf River, Clear Cypress Creek, Davis Creek, Horn Lake Creek, Little Cypress Creek, Little Laurel Creek, and Treadville Creek. For location of these watersheds, see Comprehensive Plan Map, Figure 8.1.

The development of these watersheds is a prerequisite to total control and management of the surface waters of the basin. Development of at least some of these watersheds must precede any future works of improvement on the main streams in order to reduce severe sedimentation.

FLOOD PLAIN MANAGEMENT

It is proposed that the flood plain lands lying along the Wolf and Loosahatchie Rivers and Nonconnah and Horn Lake Creeks, be used and managed in such a way as to limit or prevent developments that would be vulnerable to damages from uncontrolled floods. Such flood plain management should also extend into some tributaries of the four major streams.

It must be recognized that a flood plain is just as living and natural a thing as the river itself and not simply a place formed by past action of the stream. Flood plains carved by periodic major floods will always be required to pass the occasional water surplus not controlled by upstream works of improvement. Since floods are not constantly in evidence, man is not inclined to adjust development to allow for these infrequent requirements of flooding. Consequently, without wise advance planning, serious flood damages including loss of life and social dislocations, continue to occur.

Flood hazards in the Nonconnah flood plain are being compounded by the two processes of urbanization of the watershed which increases the rainfall runoff and intrusions into the flood plain which create temporary impoundment. There is less encroachment into the Wolf River flood plain, but the pressure for expansion of urban development is gradually bringing on land fills and structural development. The Horn Lake Creek flood plains are threatened by rapid expansion of urban developments likely to encroach on lands subject to flooding. The broad flood plains of the Loosahatchie River, now only sparsely used except for agricultural purposes, will feel the pressure for intensive development by the year 2000.

Flood plain information reports have been developed for the Wolf and Loosahatchie Rivers in Shelby County and for Nonconnah Creek. This and other hydrologic data available from the Soil Conservation Service can serve as the basis for developing policies and programs to prevent flood damages. Recommendations are being prepared for use of local government in flood plain management.

RECREATION DEVELOPMENT

Four reservoir sites were identified as suitable for recreation development within designated watersheds. Two of these are in the Nonconnah Creek Watershed, one is in the Upper Reach Wolf River, and one is in the Lower Reach Wolf River Watershed. Together, they would provide 3,555 surface acres for water-based outdoor recreation. It is proposed that these four lakes be developed with cost-sharing under Public Law 84-566 and the local watershed project sponsors.

During the course of the basin survey, special studies were made on five reservoir sites at the request of the Shelby County Conservation Board. Each of these sites are within proposed parks located at Bartlett, Rocky Branch, Germantown, Bridgewater, and Cordova. The total park area, as proposed by the conservation board, would be over 2,100 acres. Permanent recreation pool areas would total over 500 acres. Each reservoir is also designed to store floodwaters. These parks and reservoirs are located in Shelby County generally east of Memphis in the path of future urban growth. They have potential for supplying open space and recreation for the demands of an expanded population. They are included as a part of the comprehensive basin plan and will be developed by Shelby County along the lines of Casper Creek Park near Millington, Tennessee.

Greenways along both banks of Nonconnah Creek, Wolf River and Loosahatchie River within Shelby County, Tennessee, will provide recreational opportunities for hiking, horseback riding, picnicking, and nature study. The greenbelts as proposed would compliment and enhance other greenways such as the Mississippi River Greenway, Presidents Island Greenway and the City Riverfront Development proposed in earlier studies by private planners.

IMPROVEMENT OF ENVIRONMENTAL QUALITY

All of the developments proposed in the comprehensive plan will contribute toward the improvement of the overall quality of environment in the basin. Pollution of streams by silt and sediment will be reduced by the land treatment program and the water storage reservoirs. The scars of erosion that deface and mar the scenic qualities of the basin will be repaired and vegetated. Fish and wildlife resources will be enhanced by improvements to the habitat and by better management of hunting and fishing. Floods that deposit sediment and debris on bottom lands, block transportation, and make farm lands inaccessible will be reduced. The depletion of soil resources, the diminishing quality of fish and wildlife habitat, and the overcutting of the larger-sized timber trees will be largely remedied by developments proposed for the basin plan.

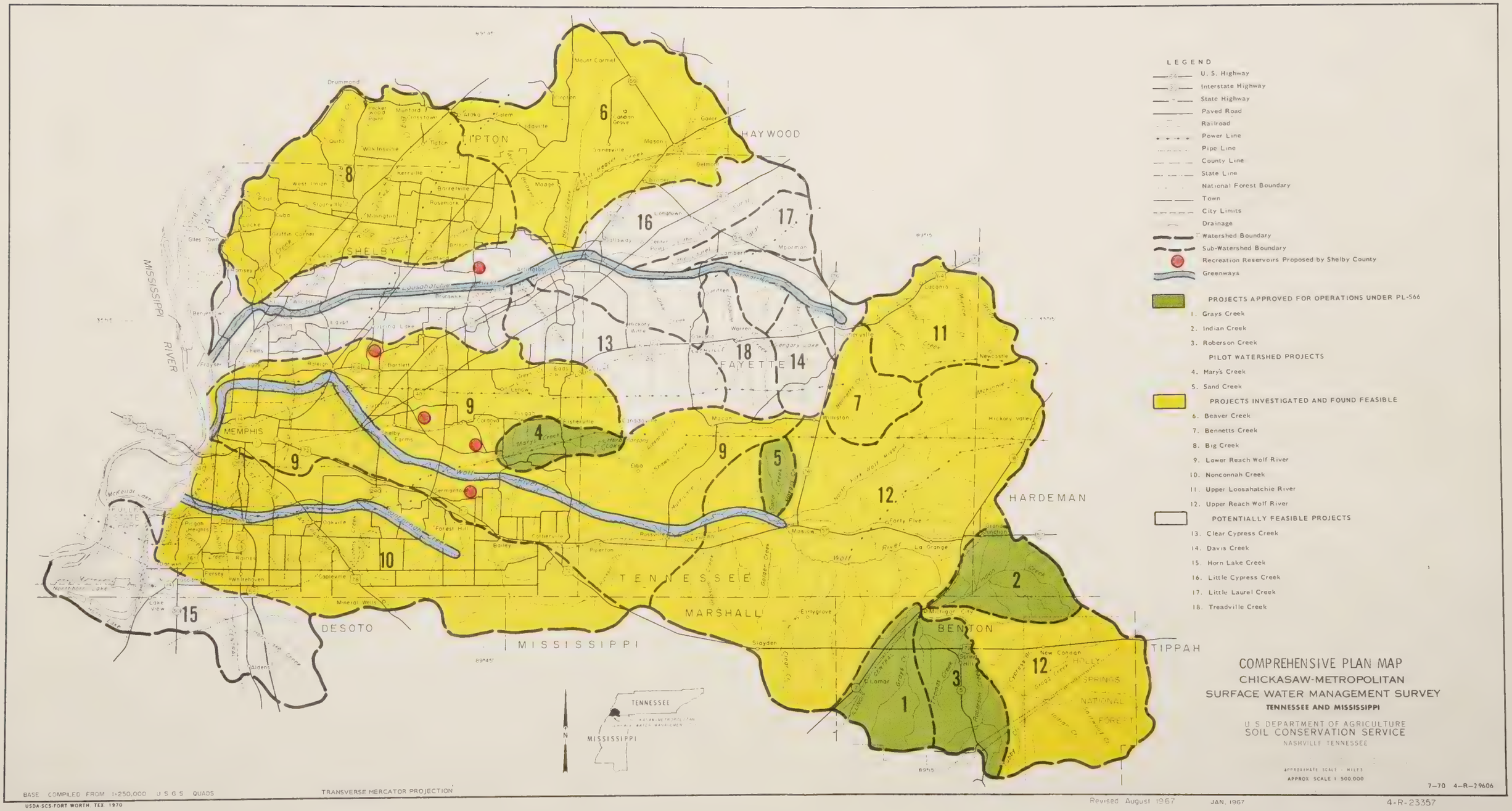

LEGEND
U. S. Highway
Interstate Highway
State Highway
Paved Road
Railroad
Power Line
Pipe Line
County Line
State Line
National Forest Boundary
Town
City Limits
Drainage
Watershed Boundary
Sub-Watershed Boundary
Recreation Reservoirs Proposed by Shelby County
Greenways
PROJECTS APPROVED FOR OPERATIONS UNDER PL-566
1. Grays Creek
2. Indian Creek
3. Roberson Creek
PILOT WATERSHED PROJECTS
4. Mary's Creek
5. Sand Creek
PROJECTS INVESTIGATED AND FOUND FEASIBLE
6. Beaver Creek
7. Bennetts Creek
8. Big Creek
9. Lower Reach Wolf River
10. Nonconnah Creek
11. Upper Loosahatchie River
12. Upper Reach Wolf River
POTENTIALLY FEASIBLE PROJECTS
13. Clear Cypress Creek
14. Davis Creek
15. Horn Lake Creek
16. Little Cypress Creek
17. Little Laurel Creek
18. Treadville Creek
TIPTON
HAYWOOD
SHELBY
FAYETTE
HARDEMAN
MEMPHIS
TENNESSEE
MARSHALL
BENTON
DESOTO
MISSISSIPPI
TIPPAH
MISSISSIPPI RIVER
TENNESSEE
MISSISSIPPI
COMPREHENSIVE PLAN MAP
CHICKASAW-METROPOLITAN
SURFACE WATER MANAGEMENT SURVEY
TENNESSEE AND MISSISSIPPI
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NASHVILLE TENNESSEE
APPROXIMATE SCALE - MILES
APPROX. SCALE 1 500,000
7-70 4-R-29606
BASE COMPILED FROM 1:250,000 U.S.G.S. QUADS
TRANSVERSE MERCATOR PROJECTION
USDA-SCS-FORT WORTH, TEX. 1970
Revised August 1967
JAN. 1967
4-R-23357

Figure 8.1

In addition to the above improvements which will occur as parts of a project action program, it is recommended that local communities take action to provide organized collection and disposal of solid waste material. Designated sites for public use in disposal of trash and refuse would go a long way toward eliminating the unsightly trash and rubbish dumps that appear all too often throughout the basin. Such sites would be selected out of the public view and where the waste material could not wash into streams or underground water. The Soil Conservation Service can provide consultive service to local communities in selection of sites suitable for waste disposal from the standpoint of soil and drainage features.

Implementing the Plan

Two alternative early action programs are presented for implementing the comprehensive basin plan. Each is based on a 15-year time frame. Both alternatives would require additional federal authority to carry out the program outside of watershed areas.

Alternative I most nearly satisfies the needs for closing the conservation gap and achieving resource development in a reasonable length of time.

Alternative II would provide for a substantial beginning towards implementation of a plan, but would not solve pressing problems or provide needs for resource development projected by the end of the 15-year period.

Alternative I

The Alternative I program would relieve the most urgent water and related land resource problems of the basin and satisfy resource development needs. It would include a sequence of measures to control erosion, reduce sediment and flood damages; develop fish, wildlife, and forest resources; provide outdoor recreation and make adjustments in land use.

The program would require that the Secretary of Agriculture be authorized to provide federal financial assistance to local groups and individuals for installation of certain measures. The USDA costs of this program would total about $60,844,000 for the 15-year period. Elements of the Alternative I program are set forth on the following pages.

LAND USE AND CONSERVATION TREATMENT

It is proposed that the installation of needed land treatment measures be completed on about 50 percent of the agricultural land during the 15-year Alternative I early action program. This amount is based on a review of current rates of land treatment, the amount of treatment needs, and a reasonable expectation of acceleration under existing agency programs. A combination of measures will be applied on about 183,000 acres of cropland. Such measures will include grasses and legumes in rotation, crop residue management and mulch tillage.

Water stored in farm ponds would supply needs for livestock, irrigation, and recreation.

On some farms contour stripcropping would be adopted as a conservation measure.

4-30376

Grassland treatment and management, including application of fertilizer and lime for maintenance and the reseeding of grassland to assure sustained production of high quality forage, will be practiced on about 100,000 acres.

Treatment of 183,400 acres of critically-eroding sediment-producing areas includes 124,600 acres of severe sheet erosion, 13,310 acres of gullies, 1,375 acres of roadsides and 44,090 acres of other highly-eroded land. The work will consist of planting trees, grass and perennial legumes, and the construction of about 1,200 gully plugs or sediment traps and 50 debris basins. Critical area treatment would be installed with the federal government cost-sharing at a rate of 75 percent of the cost and other funds bearing 25 percent of the cost. Roadside treatment would be cost-shared equally by the federal government and other funds. This critical area treatment is necessary to protect downstream flood plains, prevent sediment deposition in reservoirs and channels, and improve water quality in streams.

Land use adjustments based upon using each acre of land within its capability will be completed on 50 percent of the agricultural lands during the 15-year early action program. This includes the conversion of 80,000 acres of Classes IV, VI, and VII cropland to a less intensive use such as grasslands or woodlands. An additional 33,000 acres of Class VII pastureland will be converted to woodlands.

A combination of forestry measures is planned. Included are protection measures consisting of accelerated fire prevention on rural forest lands, the exclusion of livestock from 40,000 acres, and healing of 3,000 acres of open gullies.

The development measures include timber stand improvement on 75,000 acres, harvesting assistance on 40,000 acres annually, and conversion of tree species and tree planting totaling 29,000 acres.

The planting program includes 10,000 acres of critical area planting and forestation of 15,000 acres of land suitable for the forest. The management, stand improvement, and planting program represents an acceleration of from 2 to 8 times the current level.

In addition, a special industry-state-federal project in harvesting assistance is proposed for 20,000 acres annually.

A cost-sharing program with local government for forestry assistance in urban areas would provide for development of noise and vista screens, barriers to overland water flow, sediment reduction, and retention of forest cover for new home and apartment areas.

Conservation treatment of urban land will be emphasized, especially to assist in control of sediment. Local policies, guidelines or regulations

would be developed to control erosion and sediment during construction operations that are carried out on about 3,600 acres annually. Following are some measures that would be used on urban land:

1. Reduce by the greatest extent practicable the area and duration of exposure of readily erodible soils during construction operations.

2. Protect the soil by using temporary vegetation or mulch and by accelerating establishment of permanent cover as quickly as possible after soil exposure.

3. Sediment basins (debris basins, desilting basins or silt traps) would be installed and maintained to remove sediment and pollution from runoff waters from land undergoing development.

4. Provisions would be made to effectively accommodate the increased runoff caused by changed soil and surface conditions during and after development.

5. Permanent vegetation would be installed as soon as practical in the development process. Trees or other vegetation already present would be protected as far as practicable and allowed to remain after construction is completed.

6. The development plan would be fitted into the topography and soils so as to reduce the erosion potential. These plans would also include provisions for tree belts, green spaces, nature parks and open space areas, etc.

7. When areas are idle due to transition from agricultural land use to urban land use, natural vegetation would be retained or improved to the extent that erosion would be minimized. So far as possible, the area would be maintained in a state that will not detract from the surrounding landscape.

Land use plans prepared to guide urban or rural expansion would give full consideration to soil characteristics, topography, flood and flood plain data, and the need for best use and protection of the natural resource base.

Soil surveys will be completed on about 100,000 acres of land during the Alternative I program.

DEVELOPMENT OF WATERSHEDS

It is proposed that watershed work plans be prepared for seven watersheds during the early action Alternative I program and that installation be completed or underway on all of them. These watersheds are Beaver Creek,

Bennetts Creek, Big Creek, Nonconnah Creek, Upper Loosahatchie River, Upper Reach Wolf River and Lower Reach Wolf River.

Nonconnah Creek Watershed is already in the planning stage. Investigations on the remaining six watersheds proposed for early action have shown they are needed and feasible. Project measures would include 60 reservoirs, 230 miles of channel improvement and 63,939 acres of critical area treatment. All reservoirs would be developed to serve flood prevention purposes. Three would also be developed for water-based recreation. These projects would be initiated and carried out by local sponsors with federal technical and financial assistance.

The development of these watersheds would provide for flood control and sediment reduction and enhance prospects for future works of improvement on the main stem of Wolf and Loosahatchie Rivers.

FLOOD PLAIN MANAGEMENT

As a first step in flood plain management, it is proposed that local government purchase greenways along the major drainageways. These bottom lands would be left, for the most part, in their natural state and would not only preserve desirable open spaces for recreational and scenic purposes, but would oblige future private development to concentrate on the well-drained upland sites more suitable for construction.

It is recommended that greenway widths be set at 600 feet for Nonconnah Creek and 1500 feet each for Wolf and Loosahatchie Rivers in Shelby County. Upstream from Shelby County, the greenway widths are recommended at 800 feet. These widths could be varied as needed to conform to natural physical features and permanent man-made structures such as roads and utility lines.

The greenway on Nonconnah Creek should extend from McKellar Lake about 20 miles upstream to the site of a reservoir proposed as a result of this survey. The Wolf River greenway should extend upstream to the vicinity of Moscow. The Loosahatchie River greenway should extend to the vicinity of Somerville.

The proposals for greenways in Shelby County on each of the streams named above have previously been made by the Shelby County Conservation Board which adopted a report by Harland Bartholomew and Associates. The report was titled Program Guidelines for Conservation, Shelby County, Tennessee.

The types of greenway developments proposed in the report for Shelby County should be extended into Fayette County. Flood plain land outside the public-owned greenways in both counties should be limited to developments capable of withstanding flooding, such as agriculture, forest, parks, wildlife areas and recreation facilities. Structures such as industrial, commercial and residential that are vulnerable to high damages and tend to

block flood flows should not be allowed to develop inside the flood zone of the drainageways.

Flood damage prevention, including zoning, subdivision regulations, building codes, warning signs, and tax adjustments can be carried out by local government in cooperation with state and federal agencies. Each level of government would need to play a part and assume the responsibilities best fitted to it.

RECREATION DEVELOPMENT

A recreation reservoir in the Nonconnah Creek Watershed, one in the Upper Reach Wolf River Watershed and one in the Lower Reach Wolf River Watershed would be developed as part of PL-566 watershed projects. The costs of developing these reservoirs would be shared between the federal government and local watershed project sponsors. The five reservoirs studied by special request of the Shelby County Conservation Board would also be constructed during the early action program. They would be constructed by Shelby County, possibly with financial assistance from state or federal sources.

Other recreation developments planned for the early action Alternative I program include the greenways on the Wolf and Loosahatchie Rivers and Nonconnah Creek.

IMPROVEMENT OF ENVIRONMENTAL QUALITY

Efforts will be made to improve the overall quality of environment in the basin by abatement of agricultural related pollutants, enhancement of natural beauty, and development of rural communities.

Elements of the comprehensive plan will contribute to betterment of the environment by controlling erosion, reducing the amount of sediment that enters the streams and reservoirs, controlling and preventing flood damage, and improving fish and wildlife habitat. Application of the plan will improve the natural landscape beauty by vegetation of idle or scarred areas such as roadsides, gullies, and severely-eroded fields. Water-based outdoor recreation and hunting opportunities will be enhanced.

News media will be supplied information about pollution problems in the basin. Local civic groups, schools and religious organizations can make significant contributions to a quality environment by informing people of the needs and opportunities for improvement. Agricultural agencies, county and city government, and local organizations would be asked to lend their assistance. Civic clubs and community organizations, including women's organizations, would make significant contributions to beautification programs and in clean-up campaigns in towns and rural communities.

Soil conservation districts would take the lead in many of these activities. Districts should revise their plans of work as needed to provide for abatement of agricultural pollutants and improvement of the environment.

Development Under United States Department of Agriculture Programs

PUBLIC LAW 46, THE SOIL CONSERVATION ACT

The Soil Conservation Service would provide planning and technical assistance in making land use adjustments and applying land treatment measures. Such assistance would be rendered through existing soil conservation districts. The Service will encourage districts to obtain agreements from landowners and operators to carry out conservation plans on at least 50 percent of the agricultural land in the Chickasaw-Metropolitan Basin during the fifteen-year period of the program. Group and community planning will be utilized in planning for land treatment, recreational developments, environmental improvements, and abatement of agricultural pollutants. Soil surveys would be increased to about 6,500 acres of mapping per year.

Land treatment measures will include conservation cropping systems, minimum tillage, and contour farming; pasture and hayland planting, renovation and management; diversion construction, on-farm drainage systems, and waterways, wildlife habitat development, and tree planting.

It is estimated that conventional land treatment costs as distinct from critical area treatment, would amount to $1,572,350 annually. Approximately 65 percent of the cost or $1,020,350 would be borne by the individual landowner or operator and about 35 percent through the Rural Environmental Assistance Program. Funds for technical assistance under PL-46 for the Soil Conservation Service would be increased about 100 percent from approximately $110,000 to $240,000 annually. This would represent an increase of about seven man-years annually of technical assistance for planning and application of land treatment practices.

Critical are treatment for land stabilization and sediment reduction is a vital feature of the basinwide comprehensive program. To apply these measures during the Alternative I program will require federal cost-sharing for application, increased technical planning assistance, and an expanded education and information program. The installation of critical area stabilization measures will produce public benefits of a dispersed nature, extending far downstream, which are vital to the use and improvement of other resources. It is proposed that the federal government assist in the installation of critical area treatment measures by bearing 75 percent of the cost of critical area treatment and 100 percent of the cost of technical assistance.

Critical area treatment would consist of establishing grasses and legumes, tree planting, shaping and site preparation of gullies and roadbanks, and the construction of gully plugs, desilting basins, drop inlets, and overfall structures. The establishment of deep-rooted, close-growing plants

such as sericea lespedeza, love grass, Bermuda grass, kudzu, and other drought-tolerant plants would be carried out on the moderately damaged sites. Fertilization and liming according to soil test and mulching would be used as needed. Pine tree seedlings, kudzu, or shrub lespedeza plants would be planted on the more severely eroded areas.

Federal funds for installation of the critical area vegetative planting would be used to furnish needed heavy equipment for shaping land and filling gullies and for materials such as seed, plants, fencing materials, lime and fertilizers. The landowners would furnish all other items required and would prepare an adequate seedbed and establish vegetation. This includes labor, farm machinery and the transporting of materials.

Such a cost-sharing program for critical area treatment outside of watershed areas would be administered by the Soil Conservation Service in the same manner as is being done in watershed projects. Check dams, desilting basins, gully plugs, and diversions would be used to stop sediment resulting from severe erosion until permanent vegetative cover could become established.

Critical area treatment is estimated to cost $981,750 annually with local cost being $216,860. Federal funds would be required in the amounts of $636,840 for practice assistance and $128,050 technical assistance. An estimated Federal expenditure of $11,473,350 would be required over the next 15 years. Operation and maintenance of all critical area treatment would be carried out by the individual landowners and operators in accordance with written agreements developed with soil conservation districts. The estimated annual cost of the operation and maintenance for the critical area treatment is $250,000.

It is proposed that a soil conservationist trained to deal with urban conservation problems be assigned to the basin on a full-time basis. His responsibilities would consist of working with local government, planning groups and soil conservation districts to develop guidelines, policies and regulations in urban conservation and sediment control. On-site assistance would be supplied for construction projects on a limited basis, but most of the work would be through group consultation and by providing conservation information. Advice and assistance in planning land-use programs would be included as an integral phase of assistance. Special assistance in urban problems would be supplied to other Soil Conservation Service employees and other agencies in the basin. The estimated annual cost of these services is $20,000.

RURAL ENVIRONMENTAL ASSISTANCE PROGRAM

It is proposed that cost-sharing for conservation practices be provided by the Agricultural Stabilization and Conservation Service (ASCS) through the Rural Environmental Assistance Program (REAP). Funds would be increased about 100 percent over current levels for practices to provide lasting

conservation benefits and reduce erosion to not more than 3 to 5 tons per acre per year. Practices will include establishment of permanent vegetative cover, improvement of established permanent vegetative cover farm ponds, sod waterways, terraces and diversions, strip cropping, and minimum tillage practices. It is estimated that $8,280,000 of REAP funds will be needed over the next 15 years to assist landowners and operators in applying conservation practices. This represents an annual expenditure of $552,000 REAP funds. Present payments are estimated at $276,000. Cost for technical assistance will be provided by Federal funds and will be administered by the Soil Conservation Service and the Tennessee and Mississippi Divisions of Forestry in cooperation with the U. S. Forest Service.

Land treatment costs for Alternative I are summarized in Tables 8.2 and 8.3.

FARMERS HOME ADMINISTRATION

The proposed plan of development will require that additional funds be made available to the Farmers Home Administration to make farm ownership, soil and water conservation, forestry, and operating loans to eligibe applicants to finance the local share of land treatment. Funds will also be needed for local organizations or groups to finance the cost of installing works of improvements proposed in watershed, recreation, and community developments.

It is proposed that $2,000,000 be made available annually to the Farmers Home Administration for loans to individual landowners and operators. In addition, it is proposed that loan and grant funds be made available to Farmers Home Administration for water, sewer, and solid waste disposal systems to eligible private and public non-profit bodies. It is proposed that a minimum of $1,500,000 be made available annually to the Farmers Home Administration to finance needed water, sewer, and solid waste disposal projects in the area. It is recommended that $5,000,000 be made available to the Farmers Home Administration during the 15-year installation period, to assist local interest with cost of land acquisition and other local expenses connected with watershed development.

AGRICULTURAL EXTENSION SERVICE

Educational and informational efforts will set forth the needs for land treatment, assistance available, and eligibility requirements. Special effort will be made to inform the low income farmer of the opportunities to finance conservation projects. The Extension Service will be asked to continue the educational phase of the conservation program. Special programs, news releases, radio and television releases, information meetings, demonstrations, field tours, and other methods of getting information to landowners will be implemented throughout the basin. Soil Conservation Service technicians and State Forestry Division personnel will assist in developing and presenting these education and information programs.

Table 8.2 - Summary of land treatment costs - Alternative I program
Chickasaw-Metropolitan Surface Water Management Survey

	Acres to be treated during 15-year period	Average annual costs			
		Federal cost			
		Accelerated program	Going program	Other funds	Total funds
COST-SHARING for conservation					
Treatment, ACP					
Cropland	183,000	$131,130	$131,130	$615,740	$878,000
Pastureland	100,000	105,600	105,600	211,200	422,400
Forest land	103,000	21,750	21,750	155,300	198,800
Other	65,200	17,520	17,520	38,110	73,150
Subtotal	451,200	276,000	276,000	1,020,350	1,572,350
Critical area treatment					
Gully	13,310	153,075 1/	-	51,025	204,100
Roadbanks	1,375	6,875	-	6,875	13,750
Severe sheet	124,600	311,550	-	103,850	415,400
Other critically eroding areas	44,090	165,340	-	55,110	220,450
Subtotal	183,375	636,840	-	216,860	853,700
Technical assistance					
Soil Conservation Service					
PL-46		130,000	110,000	-	240,000
Critical areas		115,400	-	-	115,400
ACP, Servicing referrals		13,800	13,800	-	27,600
Forest Service					
Critical areas		12,650	-	-	12,650
Other technical assistance		126,150	22,240	164,640	313,030
Subtotal		398,000	146,040	164,640	708,680
Total cost of land treatment program		1,310,840	422,040	1,401,850	3,134,730

1/ Includes 1,200 gully plugs and 50 desilting basins.

Table 8.3 - Forest land treatment for the Alternative I program 1/
Chickasaw-Metropolitan Surface Water Management Survey

Treatment	Acres of treatment	Other cost of going programs	Federal cost of going program	Federal cost of technical assistance	Federal cost share (ACP)	Other cost including going programs	Total cost federal	Total cost
Fire prevention and protection	305,600 (annually)	$675,000	$120,000	$240,000	-	$915,000	$360,000	$1,275,000
Critical area (gullies)	3,000	-	-	300,000	-	-	300,000	300,000
Timber stand improvement	75,000	180,000	120,000	690,000	375,000	690,000	1,185,000	1,875,000
Type conversion	4,000	2,400	1,600	28,800	27,000	49,600	57,400	107,000
Forestation	25,000	120,000	80,000	180,000	250,000	490,000	510,000	1,000,000
Forest management not otherwise listed	150,000	18,000	12,000	215,000	-	73,000	227,000	300,000
Special industry-state harvesting assistance	20,000	-	-	13,500	-	27,000	13,500	40,500
Urban forestry	20,000	-	-	225,000	-	225,000	225,000	450,000
Total		995,400	333,600	1,892,300	652,000	2,469,600	2,877,900	5,347,500

$4,897,500/15=$326,500 on 305,600 acres=$1.06/acre/year not including urban forestry programs.

1/ Data compiled by U. S. Forest Service.

PUBLIC LAW 83-566, THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

The Watershed Protection and Flood Prevention Act, Public Law 83-566 as amended, provides for projects which may include watershed protection, flood prevention, agricultural water management, municipal and industrial water supply, recreation developments, fish and wildlife development and pollution abatement. The federal government pays all construction and installation service costs allocated to flood prevention and shares up to fifty percent of construction costs allocated to agricultural water management, recreation, and fish and wildlife developments.

Watershed investigations indicate that seven watersheds in the basin are feasible for development and should be installed during the early action program. Nonconnah Creek Watershed is now in the process of being planned.

The drainage area of these seven watersheds includes 1,255 of the 1,909 square miles of the basin. Fifty-seven floodwater-retarding structures, three multipurpose structures and 230 miles of channel improvement are proposed for these watersheds. Critical area treatment will be required on 63,839 acres of sediment producing land. The estimated total installation cost of the structural program is $32,360,200. The estimated total annual cost is $1,669,463. Pertinent data on each of the seven watersheds is shown in Tables 8.4, 8.5, and 8.6.

The development of these watersheds will require action by local sponsors having the authorities specified in Public Law 566. This includes the authority of eminent domain for securing land rights. Local sponsors may be county or city government or watershed or drainage districts organized under state law. All watersheds with existing sponsors include soil conservation districts with primary responsibility for land treatment. The Soil Conservation Service will provide copies of the watershed investigation reports to soil conservation districts and other groups interested in the development of these watersheds listed as needing development. The Soil Conservation Service will also provide guidance and information to help local leadership in setting up local sponsoring organizations and filing application for planning assistance. The development of watershed work plans and the carrying out of the works of improvement will require full initiative and responsibility of local people. Cooperation of other federal, state and local organizations will be sought in achieving project objectives. The Soil Conservation Service and Forest Service will furnish technical assistance in preparing watershed work plans and carrying out the planned project measures. Financial and credit assistance will be furnished as provided under provisions of Public Law 566. The Farmers Home Administration will be asked to make loans to local sponsors as needed for local costs of project development. This will include land rights costs and administrative costs.

Beaver Creek Watershed - Drainage area 149.2 square miles. The watershed investigation report indicates that six floodwater-retarding structures

and 136,500 feet of outlet channel improvement are needed. The estimated total cost of the structural program is $1,980,400. Critical area treatment of 10,000 acres is proposed at an estimated cost of $575,000. Benefits accruing to the structural program are about $210,100. The estimated annual cost of the structural program is $112,770.

The investigation indicates that the total average annual damage amounts to $176,250. Flood prevention benefits of $183,400 annually would result from installation of structural measures. Secondary benefits would amount to $26,700 annually.

Bennetts Creek Watershed - Drainage area 28.1 square miles. Three floodwater-retarding structures and 52,200 feet of channel improvements are proposed. The estimated total cost of the structural program is $511,100. Critical area treatment of 2,515 acres is proposed at an estimated cost of $194,700. Annual benefits accruing to the structural program are $37,850. The estimated annual cost of the structural program is $28,570.

The investigation indicates that the total average annual damage amounts to $28,000. Flood prevention benefits of $28,600 annually would result from installation of structural measures. Redevelopment and secondary benefits would amount to $9,250 annually.

Big Creek Watershed - Drainage area 155.1 square miles. The watershed investigation report proposes one floodwater-retarding structure and 256,000 feet of outlet channel improvement. The estimated total cost of the structural program is $867,500. Critical area treatment of 10,800 acres at a cost of $644,000 is proposed. Annual benefits accruing to the structural program are about $91,900. The estimated annual cost of the structural program is $62,555.

The investigation indicates that the total average annual damage amounts to $79,000. Flood prevention benefits of $84,000 annually would result from the installation of structural measures. Secondary benefits would amount to $7,900 annually.

Nonconnah Creek Watershed - Drainage area 183.3 square miles. The watershed investigation indicates eight floodwater-retarding structures and one multiple-purpose structure, and approximately 59,700 feet of improved channel. The estimated total structural cost of the program is $18,417,200. Critical area treatment of 1,725 acres is proposed at an estimated cost of $177,200. Annual benefits accruing to the structural program are about $1,504,600. The estimated annual cost of the structural program is $1,091,245. The investigation indicates that the total average annual damage amounts to $373,400. Flood prevention benefits of $463,700 annually would result from installation of structural measures. Secondary benefits would amount to $140,900 annually.

Recreation is proposed in the above mentioned multiple-purpose site in addition to flood prevention. Annual recreational benefits of $900,000 are estimated including incidental recreation benefits from the single-purpose flood prevention reservoirs.

Upper Loosahatchie River Watershed - Drainage area 49.1 square miles. Eight floodwater-retarding structures, one debris basin, and 95,200 feet of channel improvement are proposed. The estimated total cost of the structural program is $950,600. Critical area treatment is proposed on 2,140 acres at an approximate cost of $280,600. Annual benefits accruing to the structural program are $82,480. The estimated average annual cost of the structural program is $55,690.

The investigation indicates that the total average annual damage amounts to $106,900. Flood prevention benefits of $65,100 annually would result from installation of structural measures. Redevelopment and secondary benefits would amount to $17,380 annually.

Upper Reach, Wolf River Watershed - Drainage area 390.6 square miles. Twenty-nine floodwater-retarding structures, one multipurpose structure, and 436,700 feet of channel improvement are proposed. The estimated total cost of the structural program is $7,082,200. Critical area treatment of 16,698 acres is proposed at an estimated cost of $2,721,700. Annual benefits accruing to the structural program are $649,300. The estimated average annual cost of the structural program is $426,770.

The investigation indicates that the total average annual damage amounts to $354,950. Flood prevention benefits of $451,950 annually would result from installation of structural measures. Redevelopment and secondary benefits would amount to $155,350 annually.

The multipurpose reservoir site proposed will offer recreation in addition to flood prevention. Annual recreation benefits accruing to the site would be $42,000.

Lower Reach, Wolf River Watershed - Drainage area 300 square miles. Two floodwater-retarding structures, one multipurpose structure and 115,900 feet of outlet channel improvements are proposed. The estimated total cost of the structural program is $2,551,200. Critical area treatment of 19,961 acres is proposed at an estimated cost of $2,692,800. Annual benefits accruing to the structural program are $254,250. The estimated average annual cost of the structural program is $168,820. The investigation indicates that the total average annual damage amounts to $203,200. Flood prevention benefits of $119,150 annually would result from installation of structural measures. Redevelopment and secondary benefits would amount to $60,100 annually.

The multipurpose reservoir site proposed will offer recreation in addition to the flood prevention. Annual benefits accruing to the site would be $75,000 from recreation.

4-30376

Table 8.4 - Distribution of development cost for PL-566 watershed projects - Alternative I program
Chickasaw-Metropolitan Surface Water Management Survey-1967 price base

Watershed projects	Federal costs		Total federal costs	Local costs				Total local costs	Operation & maint. (annual)	Critical area treatment	
	Construction	Installation services		Land rights	Administration	Construction & basic facilities for recreation	Installation			Federal	Local
Big Creek	$ 520,800	$ 107,000	$ 627,800	$ 235,200	$ 4,500	-	-	239,700	17,800	497,700	146,300
Beaver Creek	732,700	184,400	917,100	1,055,300	8,000	-	-	1,063,300	10,606	375,000	125,000
Lower Wolf	1,661,300	383,650	2,044,950	447,400	12,200	40,000	6,650	506,250	37,200	2,071,800	621,400
Upper Wolf	5,101,650	1,133,500	6,235,150	707,500	26,500	92,050	21,000	847,050	61,400	2,102,200	619,500
Nonconnah Creek	8,304,100	759,400	9,063,500	7,441,400	222,400	1,425,200	264,700	9,353,700	141,100	141,775	35,425
Bennetts Creek	314,700	83,000	397,700	111,400	2,000	-	-	113,400	2,200	150,675	44,025
Upper Loosahatchie	605,900	172,000	777,900	169,000	3,700	-	-	172,700	6,650	212,100	68,500
Totals	17,241,150	2,822,950	20,064,100	10,167,200	279,300	1,557,250	292,350	12,296,100	276,956	5,551,250	1,660,150

Table 8.5 - Comparison of benefits and cost for structural measures, PL-566 watersheds-Alternative I program
Chickasaw-Metropolitan Surface Water Management Survey
(Dollars) 1/

Watershed	Average annual benefits								Average annual cost 3/	Benefit cost ratio
	Flood prevention 2/									
	Damage reduction	More intensive use	Changed land use agriculture	Changed land use urban	Recreation	Redevelop-ment	Local secondary	Total		
Beaver Creek	115,800	42,400	25,200	-	-	-	26,700	210,100	112,770	1.8:1.0
Bennetts	20,000	8,600	-	-	-	5,050	4,200	37,850	28,570	1.3:1.0
Big Creek	58,500	-	13,700	11,800	-	-	7,900	91,900	62,555	1.5:1.0
Nonconnah Creek	373,400	-	-	90,300	900,000	-	140,900	1,504,600	1,091,245	1.4:1.0
Upper Loosahatchie River	65,100	-	-	-	-	10,180	7,200	82,480	55,690	1.5:1.0
Upper Reach Wolf River	291,000	24,000	136,950	-	42,000	88,100	67,250	649,300	426,770	1.5:1.0
Lower Reach Wolf River	83,500	4,400	31,250	-	75,000	32,050	28,050	254,250	168,820	1.5:1.0
Total	1,007,300	79,400	207,100	102,100	1,017,000	135,380	282,200	2,830,480	1,946,420	1.5:1.0

1/ Price base - adjusted normalized for benefits, operation and maintenance, and current at time watershed investigations were made for installation costs.

2/ Additional flood damage reduction benefits attributed to land treatment measures total $56,450.

3/ Interest rate - 5-1/8 percent, 100-year evaluation period.

4-30376

Table 8.6 - Physical data for feasible PL-566 watersheds - Alternative I program
Chickasaw-Metropolitan Surface Water Management Survey

Watershed	Drainage area (sq. miles)	Structures proposed (number)	Drainage area these sites would control (percent)	Sediment pool area (acres)	Recreation pool area (acres)	Length of channel improvement (miles)
Beaver Creek	149.2	6	22	711		25.9
Bennetts Creek	28.1	3	33	132		9.9
Big Creek	155.1	1	3	42		48.5
Lower Reach Wolf River	300	3	7	150	585	26.6
Nonconnah Creek	183.3	9	41	872	1920	11.3
Upper Loosahatchie River	49.1	8	46	271		18.0
Upper Reach Wolf River	390	30	28	1107	370	89.9
Total	1,254.8	60		3285	2875	230.1

PL-566 Program - For the Alternative I program, about a half-man-year of work annually would be required on the seven potential PL-566 projects. This would include most of the 3,000 acres of tree planting on gully land and half of the other critical area treatment. In all watersheds planned under PL-566, all gullies and critical area above structures must be treated. Full technical assistance cost for forestry would be about $7,000 annually.

Cooperative Forest Management - For acceleration of the regular forestry program, it is planned to carry out 5,000 acres annually of stand improvement work, 2,000 acres of type conversion and forestation in addition to 10,000 acres of other management assistance. Included would be harvesting assistance, protection from livestock, and preparation of management plans on private forests. This would require about eight foresters annually for technical assistance in Tennessee and Mississippi portions of the basin. These costs would be half federal and half state.

Critical Area Stabilization - Outside of planned watersheds under PL-566, there will be several thousand acres of critical area in need of stabilization. The total stabilization job is almost 12,000 acres. If a third of this is done under PL-566, there are 8,000 acres remaining to be done under the regular programs. A single man-year of forestry assistance is planned to accelerate the assistance given landowners on forest treatment for critical areas. Annual local costs would be $15,000 and since this is critical area, technical assistance costs would be federal.

Forest Fire Protection - Under the Cooperative Forest Fire Protection Program, both states are effectively employing proven techniques in fire prevention and control. There are some areas, however, where both states must accelerate their improvement if they are to stay ahead of a rapidly expanding population and increasing mobility of rural travelers.

Since the cost of reducing burned area to the desired limits is quite high, additional expenditures on advanced equipment and training in prevention and enforcement would be emphasized. Highly flexible and effective communications equipment, use of the most effective informational techniques, and easily transported effective equipment need to be provided. Manpower must be continually trained in information and prevention techniques and pay scales must be high enough to get and keep competent prevention, enforcement and suppression personnel. Funds need to be boosted by 50 percent to an annual figure of $85,000 and used to upgrade equipment and improve personnel capabilities. Total fire expenditures should be evenly shared between federal and state funds during the 15-year program.

A recommended schedule of obligations for federal funds to carry out the Alternative I early action program is presented in Table 8.7.

Table 8.7 - Schedule of USDA costs for Alternative I program
Chickasaw-Metropolitan Surface Water Management Survey

	Federal Funds							
	Year							
	1	2	3	4	5	6-10	11-15	Total
Watershed development								
Watershed planning costs	$ 67,000	$131,600	$163,000	$91,600	$37,800	-	-	$491,000
Structural measures installation cost	90,000	500,000	1,000,000	1,200,000	1,200,000	9,700,000	6,374,100	20,064,100
FHA loans (accelerated)	2,500,000	2,200,000	1,350,000	1,330,000	1,575,000	1,700,000	1,641,100	12,296,100
Land treatment 1/								
ASCS-REAP (accelerated)	450,000	500,000	600,000	650,000	750,000	4,500,000	830,000	8,280,000
Critical area treatment	500,000	600,000	750,000	1,000,000	1,000,000	4,000,000	1,702,600	9,552,600
Technical assistance	500,000	500,000	600,000	700,000	700,000	3,500,000	1,660,600	8,160,600
FHA loans 2/ (accelerated)	100,000	100,000	100,000	100,000	100,000	250,000	250,000	1,000,000
Summary								
Total obligations	1,607,000	2,231,600	3,113,000	3,641,600	3,687,800	21,700,000	10,567,300	46,548,300
Total loans	2,600,000	2,300,000	1,450,000	1,430,000	1,675,000	1,950,000	1,891,100	14,296,100
Total funding required	4,207,000	4,531,600	4,563,000	5,071,600	5,362,800	23,650,000	12,458,400	60,844,000

1/ Includes accelerated land treatment in watersheds proposed for Alternative I program.

2/ Estimated allocation of FHA funds used for land treatment.

Development Under State Programs

The State of Tennessee, acting through the State Soil Conservation Committee, granted immediate watershed planning priority for Nonconnah Creek Watershed, conditioned upon the local sponsors bearing the planning costs, and further provided that other watershed planning schedules in Tennessee would not be affected. Tennessee State government provided $24,000 cost sharing with local sponsors supplying the remainder of $56,000 to support this planning. Watershed planning is now in progress.

The Tennessee Department of Conservation advises with the Shelby County Conservation Board in its programs of land acquisition for parks and greenways and other conservation purposes. It is expected that the Department will continue such cooperation and assistance in carrying out the early action program of the comprehensive basin plan.

As a sponsor of the survey, the Tennessee Department of Conservation has participated in the development and review of the comprehensive plan.

Development Under Local Programs

Local entities of government will bear a significant responsibility to initiate and participate in projects to be assisted by federal or state government. This includes counties, municipalities, and other subdivisions of state and local government.

SOIL CONSERVATION DISTRICTS

Soil Conservation Districts are in the most favorable situation for informing all residents of the basin as to the content of the basin plan and the advantages in seeing it implemented. Districts will be asked to publicize the plan through the news media, at public meetings, and meetings of private groups and conservation-oriented associations and societies. The importance of carrying out the whole plan with its interdependent features should be emphasized in order to obtain maximum benefits to the people of the area.

Soil conservation districts will be requested to bear a major responsibility in cooperation with the Department of Agriculture and other agencies for carrying out the accelerated land treatment provisions of the plan. This will require the development of district plans of work with major emphasis towards meeting conservation planning and land treatment goals. It will require special emphasis in the treatment of critically-eroding sediment producing areas of the basin.

The initiative for organizing new watershed sponsoring groups to develop watersheds proposed for the early action program will in many cases be supplied by soil conservation districts. It is expected that soil conservation districts will actively promote and participate as co-sponsors in development of these seven watersheds.

COUNTY CONSERVATION BOARDS

County Conservation Boards will be expected to participate as local sponsors of watershed projects. They will be involved in acquisition and development of greenways, parks, recreation areas, open space and reservoir sites.

The Shelby County Conservation Board, a prime sponsor of the Chickasaw-Metropolitan Surface Water Management Survey, will continue its program of land acquisition for greenways on the Wolf and Loosahatchie Rivers and Nonconnah Creek.

Acquisition of land for recreation reservoirs and county parks will be continued. The surveys for acquisition of land at the Bartlett reservoir site have been completed, and acquisition is expected to be completed in 1971. The Board is a sponsor of the Nonconnah Creek Watershed project and expects to extend its sponsorship to the other feasible watershed projects as they are developed in Shelby County. The Conservation Board will cooperate with soil conservation districts, county governments, and other sponsors of watershed projects. Information on reservoir sites proposed by Shelby County are shown on Table 8.8.

The Shelby County Conservation Board plans to make multiple-purpose use of all lands acquired for conservation purposes, including flood prevention, recreation, and water pollution abatement.

WATERSHED AND DRAINAGE DISTRICTS

Watershed and drainage districts already organized, as well as others that may be organized in the basin, will serve as prime local sponsors for development of watershed programs. Such watershed project development will require close cooperation with the U. S. Department of Agriculture and other federal, state and local agencies. Astute leadership will be required by the directors of the districts to assure maximum cooperation of local people and development of watershed work plans geared to meeting local needs.

COUNTY AND CITY GOVERNMENTS

County and city governments have opportunities for major roles in the improvement of the basin environment. Some areas of direct concern to local government are solid waste disposal, flooding, sedimentation, municipal sewage treatment, and the development, regulation, and enforcement of local ordances dealing with sanitation, and urban land uses. County governments will in some cases be requested to serve as local sponsors for watershed projects. In other cases, they will be asked to assist in watershed projects under existing sponsorship by other entities. Examples of assistance needed are roadside erosion control, relocation of roads and bridges for watershed structures, and maintenance of watershed works of improvement.

Table 8.8 - Physical data for reservoir sites investigated for the Shelby County Conservation Board

Reservoir name	Drainage area (sq. mi.)	Recreation pool (acres)	Flood Storage (acre-feet)	Sediment storage (acre-feet)
Rocky Branch	2.36	88	928	327
Cordova	2.38	123	959	275
Harrington Creek	1.45	55	659	189
Germantown	2.50	126	965	187
Fletcher Creek	2.38	126	965	278
Total	11.07	511	4535	1256

Cooperation and Assistance of Other Agencies

THE BUREAU OF SPORT FISHERIES AND WILDLIFE

The Bureau of Sport Fisheries and Wildlife can make valuable contributions to the overall basin plan by continued cooperation with State and Federal agencies concerned with development, protection and enhancement of fish and wildlife resources. It is expected that the Bureau will continue its participation as a member of the biology work group considering fish and wildlife resources in watershed work plans. The Bureau will be requested to furnish expert counsel and advice in other wildlife development, enhancement and mitigation projects in the basin.

THE BUREAU OF OUTDOOR RECREATION

The Bureau of Outdoor Recreation provided an interim assessment of outdoor recreation demands during the Chickasaw-Metropolitan Survey. It can provide financial assistance grants for land acquisition and development of approved recreation facilities. Such grants would be made through the State of Tennessee under the Land and Water Conservation Fund Act of 1965.

REGIONAL, STATE AND LOCAL PLANNING COMMISSIONS

Regional, state and local planning commissions will be requested to assist by guiding other planning such as for transportation, utilities, and urban and industrial development so that they strengthen and do not conflict with the basin comprehensive plan. Planning commissions are asked to assist in explaining the nature, purpose and benefits of the plan so that it will be accepted by the public. Advice will be sought of planning commissions as detailed plans for implementing elements of the plan are prepared. These include watershed projects, recreation developments and other environmental and resource developments.

FEDERAL AND STATE POLLUTION CONTROL AGENCIES

Federal and State pollution control agencies can render valuable effort, information, and advice on how to attack the problems of air and water pollution. These agencies are the Environmental Protection Agency, the Tennessee Stream Pollution Control Division, and the Mississippi Air and Water Pollution Control Commission.

The continuing assistance of these agencies will be sought in the pollution abatement efforts within the basin. The agencies will be informed of the special needs to improve water quality to meet objectives of the comprehensive plan.

PRIVATE ASSOCIATIONS, SOCIETIES, AND ORGANIZATIONS

Private associations, societies, and organizations representing such interests as fish and wildlife, scenic rivers, outdoor recreation, forestry, history, and archeology will be contacted and asked to encourage interest in carrying out the comprehensive plan. Garden clubs and women's organizations are especially invited to promote activities related to conservation and an improved environment. The implementation of the plan will depend in large measure on the determination and willingness of these groups to influence responsible public officials to take action.

Alternative II

The second approach to implementation of the comprehensive basin plan would consist of some acceleration of going programs, but at a lesser rate than proposed for Alternative I. Watershed projects on Nonconnah Creek, Upper Wolf River, Lower Wolf River and Big Creek would be initiated during the 15-year early action period.

This program, as for Alternative I, would require additional federal authority to provide financial assistance to local organizations and individuals for installation of critical area treatment and certain other measures. USDA costs to carry out Alternative II would total about $44,385,000 for the 15-year installation period. See Table 8.14 for schedule of USDA costs.

Developments under state, local and other federal agencies would be at the same level as proposed under Alternative I.

LAND USE AND CONSERVATION TREATMENT

About one-half of the conventional land treatment measures proposed in Alternative I, as above going programs, would be carried out during the 15-year early action period. This includes adequate conservation treatment of 91,000 acres of cropland; 50,000 acres of pastureland; 51,000

acres of forest land, and 8,000 acres other land. Conventional conservation planning and treatment programs would be accelerated by additional allocations of funds from federal sources. The same kinds of conservation treatment measures would be used as set forth under Alternative I.

Primary emphasis would be given to the control of critically-eroding areas. About 91,600 acres of gullied and otherwise critically-eroding land would be treated, including 33,500 acres planted to grasses and legumes and 7,400 acres planted in trees. Approximately 700 acres of roadbanks would be treated, and 625 gully plugs and/or sediment traps installed. Protection against grazing would be established for 15,000 acres forest land. Harvesting assistance would be furnished on 10,000 acres annually and timber stand improvement practices applied to 25,000 acres. Forestation of idle, abandoned, or land unsuitable for cultivation would be carried out on 8,000 acres.

DEVELOPMENT OF WATERSHEDS

Development of four watershed projects would be initiated under Alternative II. These would include Nonconnah Creek, Big Creek, Upper Reach Wolf River, and Lower Reach Wolf River. Watershed planning is now underway on Nonconnah Creek and the other watersheds would be planned as local interest develops and priorities are set by the states. Priority for USDA assistance would be given to those watersheds doing the most to control critical erosion. Upper Reach Wolf River Watershed should be planned and installed prior to, or concurrently with, Lower Reach Wolf River.

FLOOD PLAIN MANAGEMENT

The flood plain management program would be carried out as proposed in Alternative I. The U. S. Department of Agriculture would provide flood data and counsel to local governments in establishing flood plain land use management.

RECREATION DEVELOPMENT

All recreation reservoirs proposed for the Alternative I program would be developed under Alternative II. Three of them would be in watershed projects - one each in Nonconnah, Upper Reach Wolf and Lower Reach Wolf. The five recreation reservoirs proposed by Shelby County would also be constructed and recreation facilities installed. Greenways propsed for Nonconnah, Wolf and Loosahatchie Rivers will be partially acquired and developed.

IMPROVEMENT OF ENVIRONMENTAL QUALITY

In redirecting program emphasis of the USDA agencies, special attention would be given to those elements of the comprehensive plan that tend to enhance and improve the environment. Essentially, this will consist of the same measures set forth in the Alternative I program.

Development Under U. S. Department of Agriculture Programs

PUBLIC LAW 46, THE SOIL CONSERVATION ACT

The Soil Conservation Service would make adjustments in its program goals and objectives in order to concentrate its resources in personnel and equipment towards the control of critical, sediment-producing erosion. It would give consideration to changes in staff patterns and assignments as needed to effect a redirection of efforts oriented to accomplishment of the Alternative II program.

The Service would provide technical assistance in identifying, planning and applying treatment to critically-eroding areas. It would cooperate with other USDA agencies and other federal, state, and county organizations in efforts to promote and encourage such erosion control. It would assume an aggressive leadership role in its cooperation with soil conservation districts, encouraging districts to adopt goals oriented towards the basic plan.

Such revisions or redirection of program goals can be accomplished administratively under existing authority of Public Law 46.

WATERSHED DEVELOPMENT UNDER PUBLIC LAW 566

It is proposed that watershed work plans be developed under provisions of the Watershed Protection and flood Prevention Act, Public Law 83-566, for four watersheds. These are Nonconnah Creek, Big Creek, Upper Reach Wolf River and Lower Reach Wolf River. These watersheds are described under the early action program, Alternative I. In all these watershed projects, control of critically-eroding areas and sediment will be given high priority as a means of improving water quality and reducing sediment damage. Costs and physical data for the watershed projects proposed in Alternative II are shown in Tables 8.11, 8.12, and 8.13.

RURAL ENVIRONMENTAL ASSISTANCE PROGRAM

Cost-sharing for conservation practices will be continued but the emphasis would be shifted to solving critical erosion problems and the establishment of permanent type conservation practices. To implement this program alternative, it is suggested that a minimum of one-third of the farm REAP allotment be used to treat critical areas until the farm is certified as being free of critical areas.

FARMERS HOME ADMINISTRATION

A sound land treatment and critical area treatment plan would be prepared for all FHA clients. Extra low interest loan funds would be included in most loans to aid in solving critical erosion and pollution problems.

Special promotion publicity should be given to encourage the use of FHA loans for conservation treatment and improving land use.

AGRICULTURAL EXTENSION SERVICE

A strong information and education program as well as leadership guidance would be required if a critical area and basinwide land treatment program is to be implemented. A systematic contact of communities, groups, and landowners to solve these problems would be developed. Dissemination of useful and practical information on methods, techniques, and value of such a program would become a major goal of the Extension Service.

COOPERATIVE STATE-FEDERAL FORESTRY PROGRAMS

The PL-566 Program for Alternative II requires a little more than one-fourth man years annually during installation of the four watershed projects. About 1500 acres of critical gullies would be treated in these PL566 Watersheds, with the remaining gully treatment to be done under critical area stabilization. Technical assistance costs should be about $4,000 annually.

Cooperative Forest Management activity for Alternative II includes 1000 acres of livestock exclusion, 1700 acres of stand improvement, 1000 acres of type conversion and forestation annually during the 15 year installation period. In addition, there would be 1000 acres each year of other management assistance including the preparation of forest management plans. Two foresters would be required for this level of activity. Critical Area Stabilization will require about one-man-year annually to get the remaining 6000 acres of forestation planned for gully control outside the PL566 Projects.

Forest Fire Protection would continue at current levels of activity to prevent and control fires.

Summaries of land treatment costs are presented in Tables 8.9 and 8.10.

4-30376

Table 8.9 - Summary of land treatment costs - Alternative II program
Chickasaw-Metropolitan Surface Water Management Survey

	Acres to be treated during 15-year period	Average annual costs			
		Federal cost			
		Accelerated program	Going Cost	Other funds	Total funds
COST-SHARING for Conservation					
Treatment, ACP					
Cropland	137,250	65,565	131,130	307,870	504,565
Pastureland	75,000	52,800	105,600	105,600	264,000
Forest land	77,250	10,875	21,750	77,650	110,275
Other	48,900	8,760	17,520	19,055	45,335
Sub-total	338,400	138,000	276,000	510,175	924,175
Critical area treatment					
Gully	6,655	76,540	-	25,510	102,050
Road banks	700	3,450	-	3,440	6,890
Severe sheet	62,300	155,755	-	51,925	207,680
Other critically eroding areas	22,000	82,670	-	27,555	110,225
Sub-total	91,600	318,415	-	108,430	426,845
Technical assistance					
Soil Conservation Service					
PL-46		65,000	110,000	-	175,000
Critical areas		57,700	-	-	57,700
ACP, Servicing referrals		6,900	13,800	-	20,700
Forest Service					
Critical areas		6,325	-	-	6,325
Other technical assistance		63,075	22,240	82,320	167,635
Sub-total		199,000	146,040	82,320	427,360
Total cost of land treatment program		655,415	422,040	700,925	1,778,380

1/ Includes 600 gully plugs and 25 desilting basins

Table 8.10 - Forest land treatment for the Alternative II program 1/
Chickasaw-Metropolitan Surface Water Management Survey

Treatment	Acres of treatment	Other cost of going programs	Federal cost of going program	Federal cost of technical assistance	Federal cost share (ACP)	Other cost including going programs	Total cost federal	Total cost
Fire prevention and protection	305,600 (annually)	675,000	120,000	0	-	675,000	120,000	795,000
Critical area (gullies)	1,500	-	-	150,000	-	-	150,0 00	150,000
Timber stand improvement	25,000	60,000	40,000	230,000	125,000	230,000	395,000	625,000
Type conversion	1,000	600	400	7,200	6,750	12,400	14,350	26,750
Forestation	8,000	45,000	28,000	60,000	80,000	165,000	168,000	333,000
Forest management not otherwise listed	50,000	6,000	4,000	73,000	-	24,000	77,000	101,000
Total		786,600	193,400	520,200	211,750	1,106,400	924,350	2,030,750

$2,030,750/15 = $135,400 on 305,600 acres = $0.44/acre/year

1/ Data compiled by U. S. Forest Service

Table 8.11 - Distribution of development cost for PL-566 watershed projects,
Alternative II program
Chickasaw-Metropolitan Surface Water Management Survey-1967 price base

Watershed projects	Federal costs		Total federal costs	Local costs				Total local costs	Operation & maint. (annual)	Critical area treatment	
	Construction	Installation services		Land rights	Administration	Construction & basic facilities for recreation	Installation			Federal	Local
Big Creek	520,800	107,000	627,800	235,200	4,500	-	-	239,700	17,800	497,700	146,300
Lower Wolf	1,661,300	383,650	2,044,950	447,400	12,200	40,000	6,650	506,250	37,200	2,071,800	621,400
Upper Wolf	5,101,650	1,133,500	6,235,150	707,500	26,500	92,050	21,000	847,050	61,400	2,102,200	619,500
Nonconnah Creek	8,304,100	759,400	9,063,500	7,441,400	222,400	1,425,200	264,700	9,353,700	141,100	141,775	35,425
Totals	15,587,850	2,383,550	17,971,400	8,831,500	265,600	1,557,250	292,350	10,946,700	257,500	4,813,475	1,422,625

Table 8.12 - Comparison of benefits and cost for structural measures, PL-566 watersheds, Alternative II program
Chickasaw-Metropolitan Surface Water Management Survey
(Dollars) 1/

Watershed	Average annual benefits								Average annual cost 3/	Benefit cost ratio
	Flood prevention 2/									
	Damage reduction	More intensive use	Changed land use agriculture	Changed land use urban	Recreation	Redevelop-ment	Local secondary	Total		
Big Creek	58,500	-	13,700	11,800	-	-	7,900	91,900	62,555	1.5:1.0
Nonconnah Creek	373,400	-	-	90,300	900,000	-	140,900	1,504,600	1,091,245	1.4:1.0
Upper Reach Wolf River	291,000	24,000	136,950	-	42,000	88,100	67,250	649,300	426,770	1.5:1.0
Lower Reach Wolf River	83,500	4,400	31,250	-	75,000	32,050	28,050	254,250	168,820	1.5:1.0
Total	806,400	28,400	181,900	102,100	1,017,000	120,150	244,100	2,500,050	1,749,390	1.4:1.0

1/ Price base - adjusted normalized for benefits, operation and maintenance, and current at time watershed investigations were made for installation costs.

2/ Additional flood damage reduction benefits attributed to land treatment measures total $28,225.

3/ Interest rate - 5-1/8 percent, 100-year evaluation period.

4-30376

Table 8.13 - Physical data for feasible PL-566 watersheds - Alternative II program
Chickasaw-Metropolitan Surface Water Management Survey

Watershed	Drainage area (sq. miles)	Structures proposed (number)	Drainage area these sites would control (percent)	Sediment pool area (acres)	Recreation pool area (acres)	Length of channel improvement (miles)
Big Creek	155.1	1	3	42		48.5
Lower Reach Wolf River	300	3	7	150	585	26.6
Nonconnah Creek	183.3	9	41	872	1920	11.3
Upper Reach Wolf River	390	30	28	1804	370	89.9
Total	1024.4	43		2868	2875	176.3

Table 8.14 - Schedule of USDA costs for Alternative II program
Chickasaw-Metropolitan Surface Water Management Survey

	Federal Funds Year							
	1	2	3	4	5	6-10	11-15	Total
Watershed development								
Watershed planning costs	$ 76,000	$ 76,000	$ 76,000	$ 77,000	-	-	-	$ 305,000
Structural measures installation cost	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	6,191,300	5,280,100	17,971,400
FHA loans (accelerated)	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,973,350	2,973,350	10,946,700
Land treatment								
ASCS-REAP	337,500	375,000	450,000	487,500	562,500	3,375,000	622,500	6,210,000
Critical area treatment	250,000	300,000	375,000	500,000	500,000	2,000,000	888,475	4,813,475
Technical assistance	250,000	250,000	300,000	350,000	350,000	1,750,000	425,600	3,675,600
FHA loans (accelerated)	50,000	50,000	50,000	50,000	50,000	125,000	125,000	500,000
Summary								
Total obligations	2,213,500	2,301,000	2,501,000	2,714,500	2,712,500	13,316,300	7,216,675	32,975,475
Total loans	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	3,098,350	3,098,350	11,446,700
Total funding required	3,263,500	3,351,000	3,551,000	3,764,500	3,762,500	16,414,650	10,277,850	44,385,000

1/ Includes accelerated land treatment in watersheds proposed for Alternative II program.

2/ Estimated allocation of FHA funds used for land treatment.

4-30376

Table 8.15 - Comparison of USDA costs estimated for Alternatives I and II - 15-year installation period
Chickasaw-Metropolitan Surface Water Management Survey

	Alternative I	Alternative II
Watershed Development		
Watershed planning costs	$ 491,000	$ 305,000
Structural measures installation cost	20,064,100	17,971,400
FHA Loans (accelerated)	12,296,100	10,946,700
Land treatment 1/		
ASCS-ACP (accelerated)	8,280,000	6,210,000
Critical area treatment	9,552,600	4,813,475
Technical assistance	8,160,600	3,675,600
FHA Loans 2/ (accelerated)	1,000,000	500,000
Summary		
Total obligations	46,548,300	32,975,475
Total loans	14,296,100	11,446,700
Total funding required	60,844,000	44,385,000

Measures Needed But Not Presently Available Under Existing Programs

REFUSE DISPOSAL CONTROL

Suitable facilities for refuse disposal have been too few and generally inadequate. Consequently, gullies, roadsides, isolated fields and streams have been used as dumping places for garbage, trash and other waste material. These practices create health hazards, impair natural beauty of the landscape, and pollute the streams. There is a need for establishment of regulations regarding the disposal of refuse. Such regulations should consider sanitation, the most beneficial use of land, air and water, and the need to maintain a quality environment. This should be a function of the state governments, cooperating with counties and municipalities.

LAND USE AND ZONING LAWS

Land use and zoning laws need to be adopted to cope with future population and economic expansion. Such laws should provide for the orderly growth of housing and commercial developments and, over time, correct the ill-conceived settlement patterns observed in some areas of the basin. Responsibility for this lies with county and municipal government. Assistance can be provided by state and regional planning commissions. Zoning laws should complement future development plans of local, state and federal agencies. Zoning boards should include representatives of county and municipal governments, soil conservation districts and other organizations interested in comprehensive resource development programs of the basin. Items that should be considered are: (1) locations for industrial growth, (2) areas for home sites, (3) restrictions on future use of bottom lands to limit loss of life and property from floods, (4) location of garbage and refuse disposal areas, (5) areas for agricultural expansion, (6) locations for future highways and other transportation facilities, (7) sources of water and sewage disposal facilities for future domestic needs, (8) location of school sites and other municipal, county and state management facilities, (9) regulation of roadside advertising, (10) preservation of good agricultural land for agricultural purposes, (11) preservation of natural beauty spots, historical, and recreational sites, (12) game management areas, and (13) preservation of potential reservoir sites.

CONTROL OF SEDIMENT DURING CONSTRUCTION

The erosion of earth materials and the resulting sediment carried into stream systems during disturbance by construction processes damages stream channels and reservoirs and contributes to water pollution. Grading for building sites, highway construction and utility construction are the causes of such sediment. Regulations should be prescribed requiring that sediment control measures be put into effect during such disturbance. Both state and local government should be responsible for developing guidelines and regulations to minimize this erosion and sediment problem. Such guidelines and regulations could include (1) reducing the area and duration

of exposure of erodible soils, (2) use of temporary vegetation or mulching, (3) sediment basins or silt traps, (4) diversions, and (5) seasonal construction to allow establishment of vegetation.

INDUSTRY-STATE-LANDOWNER FORESTRY COOPERATIVES

In recognition of the trend toward a lesser role by industry in actual woods operations and the need for more professional assistance in the removal of timber from landowners' forests to industry's purchase points, there should be established a cooperative joint effort of industry with landowners using state personnel and industry foresters for technical assistance. If industry would make a forester available either by cost-sharing or actually employing a man, and the state would match this for the installation period of 15 years, the federal government should provide the full cost of state personnel. At the end of this time, the management could return to the normal 50/50 sharing. The industry forester could be provided by an association of West Tennessee wood-using industries. These men would be able to locate, help prepare and supervise logging operations, thereby restoring some industry supervision of now scattered harvesting operations.

URBAN FORESTRY TECHNICAL ASSISTANCE

To provide for technical assistance in the urbanizing area, it is recommended that two foresters be hired by the city of Memphis, to work with their city planning officials and with the city and county park and conservation boards. Their function would be to plan and to help implement forest zones, forest strips for noise and sight barriers and forested areas to intercept overland flow before it reaches streams and reservoirs. They would also assist in encouraging developers to construct homes and apartment units in harmony with forest cover, leading to a minimum of shade removal in residential areas. The costs of this technical assistance should be half federal funds and half city or county funds. Total costs would be about $30,000 annually.

TAX STUDY FOR FOREST LAND

The real estate (ad valorem) tax on agricultural lands in both states accounts for relative differences in value between cropland and forest land through the assessment procedures. Recently in Tennessee the value of the timber on the land has been taken into consideration in the assessment procedures. In Mississippi, a severance tax is applied to the forest crops in lieu of the personal property tax. A study of the taxing structures in both states may be needed if assessments of forest land suitable for cropland begins to equal cropland, forcing further clearing of land presently in forest crops. Such study should be oriented toward equalization of land assessment on the basis of productive capacity of the land under its current use. In the absence of this, a special tax equalization measure may be necessary to prevent the taxing methods from forcing landowners toward improper land use and the reduction of a productive timber resource base.

IX. IMPACTS OF EARLY ACTION ALTERNATIVES

This section discusses the estimated effects from installation of early action program Alternative I and compares them with the effects from installation of Alternative II. The installation of these programs would affect the physical, biological and environmental conditions of the basin. It would affect the economic and institutional conditions and influence administration of local, state and federal resource agencies.

Physical, Biological and Environmental Effects of Alternative I

WATER RESOURCES

Water quality would be greatly improved by the structural and land treatment programs. An immediate effect would be reduction of sediment loads in those tributaries immediately below reservoirs. The overall long-range effect would be the gradual improvement of surface water quality throughout the basin. Pollution of surface water by agricultural chemicals would be reduced by applying the needed conservation measures. Vegetative cover would retard runoff and increase infiltration, tending to retain objectional water-soluble materials in the soil and reduce the amount entering streams and lakes.

Sediment and colloidal material in the streams of the basin comes from two sources. Stream movement picks up material from the stream bed and carries it in suspension. Other soil material is introduced into the stream by surface runoff from the land. Improved vegetative cover would reduce siltation and turbidity by reducing the amount of material discharged into streams by runoff. Stream movement will continue to pick up some discoloring soil particles, and because of the great amount of sediment now in transport, it would be a number of years before appreciable improvement would be observed on the main streams. It is estimated that the proposed land treatment measures, when fully effective, would reduce sediment loads by about 50 percent.

Land treatment measures would reduce runoff by about one-fourth for low-intensity rainfalls, thereby increasing detention storage by interception. Conservation measures would have less effect during high-intensity storms.

The impacts of the Alternative I forestry program on water quality, water supply and flood protection are closely interrelated. Since the effects are due largely to alteration of soil conditions which require many years, the net effects of forest land treatment during the Alternative I Program would be quite small.

The impact of the planned forestry measures on hydrologic condition would differ between the coastal plain and silty uplands land resource areas. The most significant improvement from forestry measures would be in the coastal plain uplands in the headwaters of the basin where hydrologic conditions would be improved from poor and very poor to fair. In the silty

uplands where present hydrologic conditions are much better, the expected improvement over a 50-year period would go from medium-poor to medium-fair.

Additional water supply would be available for recreation, irrigation and industrial use. Three multiple-purpose sites in watershed projects would offer 2,875 more acres of water surface for water-based recreation. Five recreation reservoirs investigated for the Shelby County Conservation Board would provide an additional 500 acres water surface.

The Chickasaw Basin is part of the natural recharge area for the abundant ground water supply in the Mississippi Delta. Part of the water impounded in the reservoirs would slowly seep into the ground and add to the ground water supply. The planned improvement in ground cover would add to the ground water supply by increasing the infiltration rates of soils.

The proposed dams in the seven feasible watersheds would store 86,000 acre-feet of floodwater. Watershed projects in the basin already in operation, including the Sand and Mary's Creeks pilot Projects, provide an additional 11,000 acre-feet of floodwater storage. The floodwater will be released slowly and will prolong stream flow. The present average annual floodwater damage in the seven watersheds would be reduced from $1,969,450 to $962,150 after project installation. Flood protection would allow higher levels of management to be practiced on flood plain lands, thereby increasing farm income and enhancing the standard of living.

LAND RESOURCES

Installation of Alternative I would develop and protect the land resource base by facilitating adjustments in land use and applying conservation treatment to reduce erosion. It would help provide for the use of land commensurate with its capability and facilitate the application of additional modern techniques in management. It would bring about beneficial changes in land use corresponding to the land's capability for sustained production based on soils, slope, and degree of erosion. The impact of the conservation program would be to speed up land use adjustments that would reduce cropland use by 56,000 acres and pastureland use by 33,150 acres. These acres are marginal, non-productive, and idle most of the time. They occupy steep or severely-eroded lands and were included in the area shown as needing critical area treatment measures. These 89,150 acres would be given conservation treatment and changed to a less intensive land use. It is estimated that the effect of such adjustment and treatment would increase grassland by 22,000 acres, woodlands by 35,250 acres, and other land uses by 31,900 acres. It is also estimated that 35,580 acres of upland forest lands would be converted to 15,000 acres cropland, 3,000 acres pastureland, and 17,580 acres of other land uses which would be used primarily for urban and water development.

An analysis of the flood protection program indicated that it would cause some land use changes. It is estimated that 16,320 acres would be needed

for floodwater-retarding reservoirs. This land is composed of 4,896 acres of cropland, 3,264 acres of pasture, and 8,160 acres of woodland. An estimated 28,580 acres of woodland would be cleared and 15,750 acres converted to cropland, 5,250 acres of grassland, and 7,580 acres to non-agricultural uses. Approximately 12,500 acres would be restored to its former productive capacity, shifting from idle or non-productive to cropland and grassland. Intensification of use would occur on 35,000 acres of cropland and grassland.

Greenways along Wolf and Loosahatchie Rivers and Nonconnah Creek would require 14,000 acres of land. Most of this area, which would act as a floodway during periods of excessive storm runoff, would remain in woodlands. Open areas which are estimated to include 2,220 acres of cropland 1,680 pastureland and 1,680 acres other, and 8,420 acres of forested lands would be reserved for public uses such as recreation, historical preserves, outdoor classrooms, and nature trails.

The overall land use changes that are expected to occur in the 15-year period of implementation of the early action program would be a decrease of 32,366 acres of cropland, a decrease of 7,844 acres pastureland, a decrease of 45,490 acres of woodland and an increase of 85,700 acres of land used for non-agricultural purposes. Other land use changes may occur for transportation developments, increased urban and industrial developments, and public uses for institutions, recreation, etc.

Gross erosion in the basin is approximately 8 million tons per year. Implementation of the plan would eventually reduce this erosion by 50 percent to about 4 million tons per year. A reduction in erosion of this magnitude would greatly reduce the sedimentation problems within the entire basin. It would reduce the rate of deterioration of both the soil resource and its productive capacity.

In looking at the future, there is no apparent reason to expect the basin to undergo a substantial change in its present share of national food and fiber production with or without resource development. However, with resource development, some gains in comparative advantage could be expected in the short run. Assuming that resource development outside the basin continues, these short run gains would be expected to dissipate over time.

Improving the forest soil resource base would be a major benefit of the planned forestry measures. Rebuilding of the forest soil to the level needed requires all of the planned measures. Hydrologic conditions of the soils would improve and the forest itself would be more productive due to higher nutrient and moisture levels resulting from the program. The generally poor condition of Chickasaw-Metropolitan Basin forests prevents full use of soils, water and growing space. The proposed program would increase the number of sound healthy trees. The trees would become larger and taller. Eventually the coastal plain soils would produce more healthy

hardwoods and pines. This is a long-term process. Fifty-year projections indicate only 80 percent of the goal can be reached.

FISH AND WILDLIFE

Implementation of the early action program would provide beneficial effects on fish and wildlife resources. Impoundments would provide 2,875 surface acres of fishing waters in the three recreation reservoirs. The 57 flood prevention reservoirs will supply 3,285 acres additional fishing waters in the sediment detention pools. The net beneficial effects of these reservoirs in increased fish and waterfowl habitat and shoreline habitat for upland game birds and animals would more than compensate for some reduction in dry land game habitat.

Sediment control through land treatment, including critical area stabilization, and sediment storage in floodwater-retarding structures would have beneficial effects on the stream fishery resources. Wildlife habitat would be increased by selection of vegetation for land treatment and critical area stabilization that provides wildlife food and cover. Additional waterfowl habitat can be provided in the 57 floodwater-retarding structures by making use of the second 50-year sediment storage capacity.

The expansion and development of public wildlife management areas and refuges would provide the needed nucleus of wildlife resource protection and management. This would demonstrate to the private sector how wildlife can be enhanced by habitat development.

Channel improvements in the proposed watershed projects will have adverse effects on both fish and wildlife habitat, but these effects would be governed by the extent of mitigation measures that are included in watershed work plans and partly by individual landowners' actions with respect to providing wildlife habitat. Some changes in habitat and species, and therefore in types of hunting and fishing opportunities, are implied by any resource development. If these changes are considered detrimental, they could be viewed as a cost of enhancing income opportunities. A negative effect on one species may be a beneficial effect to another species.

RECREATION

The Alternative I program would increase the amount of wildlife habitat and provide fishing in four multipurpose reservoirs in watershed projects. The three multipurpose recreation structures and basic facilities would provide about 678,000 visitor days of recreation annually. The type of recreation experiences provided in these structures include swimming, boating, fishing, camping, picnicking, and nature walks. The sediment pools of the single-purpose floodwater-retarding structures would provide incidental hunting and fishing opportunities and other types of recreation for an estimated 166,200 visitor days. The five reservoirs proposed for county recreation parks in Shelby County would provide 500 surface acres for an additional 95,000 visitor days recreation.

Multipurpose reservoirs that provide for water-oriented recreation have a beneficial economic impact on local communities and counties. The construction of recreation facilities creates jobs and material sales. While most forms of recreation are seasonal in nature and additional sales and employment associated with recreational enterprises likewise are seasonal, the expenditures of recreation users and developers have a favorable impact on the economy of a community and a region. Land values around and near water impoundments increase and proximity to the recreation area becomes an attraction to homeowners with consequent development of residential subdivisions and vacation or retirement type homes. Property tax revenues would increase as a result of enhanced land values.

Greenways along the Wolf, Loosahatchie and Nonconnah could furnish additional amounts of visitor days recreation estimated at 700,000 visitor days. These greenway areas would be used for horseback trails, bird watching, nature study and, in the upstream rural segments, for hunting.

ESTHETICS

The natural beauty of the basin would be improved by establishment of vegetation on critically-eroding roadbanks, gullies and other severely-eroding and sediment-producing areas. Bare surface areas would be covered by permanent grasses, legumes and trees during the application of conservation measures. Watershed reservoirs and farm ponds would provide a pleasant vista of water and green vegetation to make family recreation around these areas more enjoyable.

The appearance of the basin would benefit by the elimination of unsightly garbage and litter dumps when such solid wastes are disposed of in a systematic and orderly manner and out of view of the public. The natural beauty of the basin would be largely restored and, in many cases, enhanced through the activities of local community groups and garden clubs.

The quality of water in streams and the appearance of these streams would be improved by a reduction in turbidity and floating debris. The planned measures would help to preserve the colorful, scenic views of nature along the mainstreams of the Wolf and Loosahatchie Rivers. The forests and other plant associations, the wildlife and fish, and other elements of nature would be available for enjoyment by the public. Better economic conditions would lead to better housing conditions and the elimination of unsightly shacks and automobile junkyards. The appearance of farmsteads would be improved.

The establishment of forest on eroded land not only improves the soil conditions, it has also a pronounced effect on esthetic quality. The following two photos taken before and seven years after gully stabilization work show how the landscape in the rural part of the Chickasaw Basin has been improved. The benefits here include soil stability, increased capability for plant growth, runoff retardation, esthetic improvement, and, in a few more years, pulpwood profits.

Coastal Plain gullies need cover. Here, tree planting is the recommendation.

In seven years, protection is complete and soil rebuilding can begin.

4-30376

Results of the urban forestry program would have considerable esthetic impacts. Three results would be noise abatement, temperature reduction (shade), and water quality improvement through sediment control. There would be improvement in the appearance and character of the urban community.

Very little has been sacrificed to build on wooded lots without clearing the trees. Much has been gained in shade, protection of soil from direct rainfall and enhancement of the apartments' landscape.

Shade has been shown to reduce the average temperature around buildings 10 to 15 degrees fahrenheit. In this warm climate such a reduction adds greatly to living comfort.

Water quality improvements are directly related to amounts of runoff from unprotected soil surfaces in urban areas as in rural areas. Similar degrees of improved water quality are possible.

Economic Impacts of Alternative I

The economic impacts of the Alternative I plan can be conceived of or measured in several different ways. Not all of the economic effects expected are monetary and these can only be arbitrarily quantified. Some effects are direct and easily established while others are less obvious

and evolve as economic adjustments, stimulated by the development itself, are made. In this section an attempt was made to establish the more important economic effects of the proposed plan. There probably exists other effects, both beneficial and detrimental, which have not been identified.

The economic effects of flood protection, one of the major plan elements was evaluated more intensively than the other elements. The gross economic effect of this activity was evaluated in two different ways. One is oriented toward local benefits, while the other is toward national effects. To develop net effects at the local level, the local costs would have to be subtracted from gross local effects and at the national level total costs from gross national effects.

LOCAL EFFECT OF FLOOD PROTECTION

Local benefits from flood protection were based upon reduction of damages in the flood plain and benefits expected from intensified and changed land use resulting from this development. This evaluation was conducted on all watershed projects proposed for implementation in the early action program and the individual watershed results were aggregated to represent basin benefits.

Total annual benefits in the seven watersheds resulting from damage reduction, more intensive flood plain use, changed land uses, recreation, redevelopment and local secondary benefits are estimated to be approximately $2,830,400. Total damage reduction benefits amount to approximately $1,007,300 and consist of reductions in damages to crops and pastures, roads and bridges, other agricultural buildings, fences, roads and urban properties. Benefits from changed land use are estimated to be $309,200, and $79,400 in benefits are expected from more intensive use of the protected acres. Recreation, redevelopment and local secondary benefits amount to $1,017,000, $135,380, and $282,200 respectively.

NATIONAL EFFECTS OF FLOOD PROTECTION

A basic national objective is efficient production of food and fiber. Evaluation of the national effect of flood protection refers only to this objective and does not include the national effect of protecting roads, bridges, buildings, and other physical improvements. The national framework projections for the Chickasaw basin reflect historical production patterns and the comparative advantage of the basin's agricultural resources in the production of expected national food and fiber needs. However, thenational framework projections do not account for additional gains in agricultural efficiency possible through new public water resource development investments in the respective basins. Accordingly, if farmers in a basin can produce the food and fiber identified for the area in the national framework projections through water resource development with fewer resources at a lower cost, opportunities for beneficial national

effects appear possible. Potential efficiency gains or cost savings on farms in food and fiber production must be compared with the public and private off-farm costs before favorable national effects can be identified.

A linear programming analysis was used to help establish the cost of providing the basin's projected production with and without flood protection. The analysis was conducted concurrently for two Type 4 river basin studies, the Chickasaw-Metropolitan Surface Water Management Survey and the Hatchie River Basin Survey. Each basin was treated as a subbasin in the analysis.

The linear programming analysis included 18 proposed watersheds in these two basins. Eleven of the 18 were in the Chickasaw. The 18 watersheds would provide flood protection for approximately 80,200 acres of agricultural flood plain land.

The programming analysis provided a means of examining the geographic distribution of some of the effects expected. For example, providing flood protection would be expected to cause some shifts in the location of production. In reality, part of these changes would occur within the basin and some adjustments would be made in other areas, but the analysis forced all of the adjustments inside the basin. Therefore, the magnitude of the internal results is probably over-emphasized, but the direction of change should be relevant.

The cost of production expected with and without flood protection was established for the future year 2000. A basic assumption was that the Chickasaw-Hatchie Basins' total production would not change. Therefore, gross returns would not change for the basin with resource development, but net returns may change for any subgroup of land resource within the basin with flood protection. The results indicated that the soil resource groups in the bottom land would gain slightly over 2.2 million dollars in net returns, whereas the uplands would lose almost 1.9 million dollars.

National efficiency gains as a result of flood protection in the two basins are estimated to be about $400,000 annually. This would indicate the national effects attributable to development in the Chickasaw to be approximately $250,000. The efficiency gains identified assume that flood plain and upland land-use changes reflect correctly changes in land use in other regions of the nation.

The marginal resource (upland in this case) in the Chickasaw-Hatchie Basin is predominantly in the Hatchie area. The analysis indicated that this basin would experience the major part of the upland decrease which resulted in the aggregate effect on the Hatchie being negative and the Chickasaw realizing an increase in net returns of over one million dollars.

In general, the soils in the Southern Coastal Plains land resource area are recognized to be less productive than those in the Southern Mississippi Valley Silty Uplands. However, the grouping of soils into soil resource

groups has probably resulted in some aggregation bias and the upland losses in net returns might be distributed between the two basins more than is indicated in this analysis.

EFFECTS OF FORESTRY

Economic effects of the forestry Alternative I for the Chickasaw-Metropolitan Basin project are generated in two ways: (1) Forest management inputs increase the economic potential of individual forests. The proposed $1.06 per acre annual expenditure on forest land represented in the basin plan would increase the dollar value of basin forest from $0.91 per acre to $4.26 per acre annually. (2) Land use changes affect the total basin forest production. An increase in value of four times reflects the projected changes in land use needed to meet the basin's share of national food and fiber requirements. Forest area is projected to increase by 100,000 acres in the year 2000, then decrease to very slightly below the 1965 level in 2020 at 303,000 acres. The 2000 level is necessary to meet the demands projected for that period.

An analysis of the year 2000 with and without the proposed PL-566 projects shows a shift of forest from tillable bottom land to less suitable bottom land and certain uplands. The net effect is an annual $502,000 reduction in value of forest products grown. This results from project-induced land clearing that moves forest from highly productive soils supporting valuable timber to lesser productive soils that are unable to grow high value wood products. This half-million dollars represents a 3-1/4 percent reduction of the gross before project value. These losses are regional in nature and are in addition to the benefits to forestry foregone that were deducted in the economic evaluation of each individual project. The 3-1/4 percent is not considered enough to justify any adjustment in the proposed projects but serves as a caution to planners that cumulative effects of several individually justified projects may generate a regional cost not otherwise apparent.

The value of forest products manufactured from wood grown in the Chickasaw-Metropolitan Basin is projected to increase from a 1965 level of $3,272,000 to $15,234,000 in the year 2020. The basins' expected share of national needs indicates this level of value should be reached by the year 2000, but it is highly unlikely that these needs can be met. Forest management programs would have to be fully implemented and highly effective by 1980 to achieve such a goal at the end of this century. This value of wood products in 2020 does not compare to the projected 11 million dollars for 2020 reported in Chapter III. In Chapter III, historical trends were projected. These include an expected exploitation of the forest resource base which results in a reduction of the long-term dollar capability. This reduction had already begun by 2020 according to the projections. Projected demands for wood products from this basin exceed the projections of historical cutting trends by 50 percent. This occurs by 2000 and holds through 2020. Sustained yield production under projected attainable good

management could meet the demand in 2020 but not the earlier demand in 2000. It was not found feasible to meet any of the demands without the recommended forest management program and no projections of values without management resulted from the analysis.

It is expected that employment in the harvest, primary and secondary manufacturing parts of the industry should hold a better position with the proposed program. The net effect would be to hold the employment reached in the year 2000 at or near the 1920 persons employed and continue at this level rather than drop off as otherwise projected. The increase, above the projected level, would be 34 percent attributable to the program.

Urban Forestry - The result of providing wooded sites for homes and apartments, of having forested screens and wooded recreation areas would be higher home values, higher tax base, higher possible rent income all due to more desirable living conditions. Wooded lots sell for higher prices and, in fact, are advertised in the Memphis real estate market as wooded lots to take advantage of the values imparted by trees to the property.

Desirability of the community in general can be reflected in the prices persons are willing to pay for homes, and the taxes they are willing to bear to live in that community. Wooded communities with parks and out of visible touch with industry and highways draw persons willing to pay the price for more comfortable living afforded by wooded communities. Dollar benefits for these values have not been determined.

EFFECTS OF RECREATION

The recreation developments proposed are expected to improve the well-being of basin residents and increase economic activity in the basin. Three recreation reservoirs in watershed projects and five to be built by Shelby County would provide water-oriented recreation values at $2,067,000 annually. This is computed at $1.50 per recreation day for 1,378,000 days on all sites.

Incidental recreation in other watershed reservoirs is valued at $83,100 annually. The development of greenways can provide additional recreation values, estimated at $350,000 annually. However, this will be a local project and planning of facilities has not developed to the point that exact economic benefits and cost can be determined.

To evaluate the efficiency of the proposed water-based recreation structures, an econometric model which minimizes travel costs for recreationists was also used. Results of this model indicated the locational value of providing recreation for the Memphis Standard Metropolitan Statistical Area in the immediate proximity such as in the Chickasaw Basin rather than in other basins. However, recreation quality was not considered in the analysis. In general, the environmental quality of the Hatchie Basin is superior to many of the other basins in the Memphis area. For this reason, three multipurpose structures were included in the Hatchie plan--McNairy-

Cypress, Tipton County-Indian, and Little Hatchie Creeks--to help supply the expected recreation demand for residents in the Chickasaw Basin.

The provision of recreation for basin residents is not expected to generate much additional economic activity, but it will enhance the well-being of the basin people. The national impact of the recreation plan was not computed. However, the water-oriented recreation proposed in the plan would amount to less than the total expected demand for the basin. Therefore, the local economic effect should also be representative of the national effect.

EFFECTS ON EMPLOYMENT

The provision of additional recreation opportunities is expected to increase employment and non-farm income through the sale of recreational supplies and operation of the recreational developments. The combined effect of land treatment and flood protection is not expected to influence employment significantly except through construction and operation and maintenance.

The enhancement of the basin's industrial appeal through environmental quality improvement and the reduction of the flooding hazard should help the basin generate industrial growth. Some of the information developed during the course of the study will be helpful in city planning for industrial growth. However, the magnitude of this effect or the additional employment that would result is unknown.

EFFECTS OF CONSTRUCTION, OPERATION, AND MAINTENANCE

A total of about $39,571,600 would be expended during development of the seven early action watersheds and an annual expenditure of about $277,000 is expected to occur after development for operation and maintenance. Construction of these projects is expected to provide 1,125 man-years of basin employment. In addition, 180 man-years of employment is associated with operation and maintenance during the 15-year installation period and 24 annual man-years of employment after project installation.

An employment multiplier of 2.3 was presented in the economic section. Application of this multiplier would indicate that a total of 3,000 man-years of employment in primary and secondary activity would be generated during the installation period and 31 man-years per year after installation.

Administrative and Institutional Impacts of Alternative I

U. S. DEPARTMENT OF AGRICULTURE

Agencies responsible for administration of natural resource programs in the basin include the Soil Conservation Service, Farmers Home Administration, the Agricultural Stabilization and Conservation Service and the Forest Service. The early action program would require reorientation of these agency programs to accelerate land treatment and flood prevention measures.

4-30376

The Soil Conservation Service would need to adjust priorities in the planning and installation of watershed projects. Watershed planning should be facilitated inasmuch as feasibility determination and tentative project development programs have been made during the basin survey. Acceleration of the conservation planning, land use conversions and land treatment program would require the assignment of about thirteen additional employees to work in the basin. This would cost about $259,200 annually. The Soil Conservation Service would need to work with soil conservation districts in updating plans of work to focus on implementation of the basin program.

The Rural Environmental Assistance Program would be accelerated to provide for doubling the rate of application of selected practices that are most effective in reducing erosion and sediment damage. This increased cost would be about $276,000 annually. There would be no significant administrative or organizational impact.

Additional obligational authority estimated at $3,847,000 annually would be required by the Farmers Home Administration. This would include farm ownership, soil and water conservation, forestry and operating loans and loans for water and sewer projects, solid waste disposal systems and land rights acquisition for watershed projects.

Since there is no recommended acceleration of the National Forest Program, there would be no program impact on the administration of the 11,840 acres of national forest land in the basin.

STATE FORESTRY DIVISIONS

Forestry Division programs would be greatly affected by the proposed program. Foresters would be needed for technical assistance and supervision at several levels in the two state organizations.

Mississippi's forestry program would have a slightly smaller impact than Tennessee. In Mississippi, the 15-year program would need one-half man-year of professional time for increased fire prevention activities. In critical area treatment, one-fourth man-year is needed. In the watershed projects another quarter man-year of professional service is needed. In accelerating the overall forestry program, two full-time professionals are required by the projected workload. The special harvesting assistance effort would need a half man-year to provide the Mississippi share of the work. This comes to 3-1/2 man-years at a cost of $42,000 annually. With another 20 percent for overhead, the Mississippi program would cost $50,000 annually for 15 years of installation.

In Tennessee, a professional forester would be needed for a half-year to lead accelerated fire control efforts. To treat critical area, the land treatment forestry work would need a quarter of a professional's time. For technical assistance in watershed work, another quarter man-year is required. Accelerating the going cooperative forest management program calls for adding two full-time professionals. Another forester is needed

for the Industry-State Cooperative Harvesting Assistance Program if it is initiated. The cost to Tennessee would be about $50,000 each year. Adding the 20 percent for overhead runs the full cost to $60,000 annually. The city of Memphis, or Shelby County, would bear a cost of about $30,000 annually to have a forester assigned to the planning authority and another assigned to handle urban forestry requests and other activities.

Table 9.1 - Additional manpower and costs of state and city forestry programs
Chickasaw-Metropolitan Basin

Program measure	Annual man-years of work		
	Mississippi	Tennessee	City of Memphis (or Shelby County)
Fire control	1/2	1/2	
Critical area treatment	1/4	1/4	
PL-566 watersheds	1/4	1/4	
Cooperative forestry	2	2	
Special harvesting assistance	1/2	1	
Urban forestry program			2
Total	3-1/2	4	2
Annual cost	$50,000	$60,000	$30,000

SOIL CONSERVATION DISTRICTS

Soil conservation districts would experience sharply increased workloads as the early action plan is installed. An early need will be revision of district work plans to focus on carrying out the basin plan. As the land treatment and watershed development programs are accelerated through agency action, district activities would need to accelerate at an equal rate. Districts would find a need for more board meetings and additional clerical assistance. The demands for a leadership role would be thrust more urgently upon district supervisors. The installation of the early action program lays a challenge to districts that can place them firmly in command of local resource development and environmental improvement programs.

LOCAL GOVERNMENT

County and municipal governing bodies would be asked to participate in the implementation of the basin plan especially in the elements concerned with pollution control, solid waste disposal and zoning. Local government would be asked to co-sponsor watershed development projects. In other cases their cooperation would be needed by already sponsored watershed projects in such measures as road relocations required for structural measures, development of recreation facilities, and maintenance of watershed project features. Local government should expect to bear a part of

the costs of the early action program that concerns environmental quality improvement. Amount of these costs would be quite difficult to calculate inasmuch as each county or municipality would participate in widely differing amounts based on local interest and enthusiasm.

Comparison of Impacts from Alternatives I and II

The foregoing discussion of impacts from the Alternative I Program applies for Alternative II except in quantity. Alternative II is a scaled-down version of Alternative I; therefore, the impacts would be less. The estimated quantitative effects of the two programs are compared in Tables 9.2 and 9.3.

The effect on water quality by sediment reduction would be about one-half as much for Alternative II as for Alternative I. The reduction in sediment from 2 million tons for Alternative I to one million for Alternative II is proportional to critical area treatment and other land treatment measures for the two alternatives.

The impacts of the Alternative II forestry program are quite limited since the only real accelerated improvement is in the reduction of sediment produced from gullied critical areas. This would be about half the improvement expected as a result of Alternative I. Water quality improvement directly attributable to gully stabilization would also be half that expected from Alternative I.

Hydrologic conditions in the four proposed watersheds would be accelerated in their improvement, while remaining areas would continue at the current, somewhat lesser rate. Conditions on the average are projected to remain poor, though some improvement in smaller upstream tributaries is expected.

The improved forest resource base is projected to reach only 48 percent of the long term goal under Alternative II as contrasted with 80 percent for Alternative I. Alternative II has no acceleration of forest productivity beyond the current improvement level. The $0.44 per acre expenditure will not have as great an impact on the increase in per acre income from forest products as will the shortage of these products. The long range impact of such a low investment will be the replacement in the market of forest products with less costly synthetic materials.

Development of only four watershed projects in Alternative II instead of seven proposed for Alternative I would reduce annual flood damage reduction from $1,007,300 to $806,400. Total annual benefits from watershed projects in Alternative II would be $2,500,000 as compared with $2,830,500 for Alternative I.

Reservoirs in the four watershed projects under Alternative II would store 65,000 acre-feet of floodwater compared with 86,000 acre-feet for Alternative I.

The Alternative II Program would provide acceleration of land treatment at about one-half the rate for Alternative I, including critical area treatment. It would result in a reduction of cropland by about 30,000 acres and pasture of about 16,000 acres. Most of the cropland would be converted to pasture and the reduction in pasture would be added to forest.

Conservation treatment and land use conversions under the Alternative II program would reduce gross erosion from about 8 million tons per year to about 6 million tons per year.

There would be no significant difference in the impacts of the two alternatives on fish and wildlife resources except that reservoir impoundments in Alternative II would be 5,046 acres instead of 6,160 acres for Alternative I, providing 1,114 acres less for fishing waters and waterfoul habitat.

As in Alternative I, Alternative II does improve the rural landscape with the vegetation of gullied areas. It can be expected that, in a lesser program such as this, the most critical and necessary areas needing treatment will also be the most obvious. The result is that aesthetic improvements should be nearly as high as in Alternative I.

For the implementation of Alternative II, U. S. Department of Agriculture agencies would adjust priorities to accelerate going program. Instead of adding 13 employees at a cost of $259,200 annually for Alternative I, the Soil Conservation Service would need to add eight employees for Alternative II at an annual cost of $165,000.

The significant impact of the accelerated critical area treatment and four PL-566 projects on state employment would be in Tennessee, where an additional man would be needed for Alternative II above that level now authorized. State cost would be about $7,500.00 annually. This compares with a need for four foresters to emplement Alternative I.

The major impacts of the Alternative II program would result from installation of four watershed projects, accelerated land treatment and outdoor recreation development. Implementation of Alternative II, while it would fall short of meeting needs and problems, could make a substantial contribution to the basin environment.

Table 9.2 - Comparison of Impacts - USDA Alternative Programs I and II
Chickasaw-Metropolitan Basin

Program elements	Basin needs		Alternative I	Alternative II
Land use and conservation treatment	Total land treatment	813,700 Ac.	337,000 Ac.	225,000 Ac.
	Cropland	366,100 Ac.	183,000 Ac.	91,000 Ac.
	Grassland	165,200 Ac.	100,000 Ac.	50,000 Ac.
	Forest land	260,000 Ac.	103,000 Ac.	51,000 Ac.
	Other land	22,400 Ac.	11,200 Ac.	8,000 Ac.
	Critical area treatment	183,400 Ac. 1/	183,400 Ac.	91,600 Ac. 2/
	Grasses and legumes	67,130 Ac.	67,130 Ac.	33,500 Ac.
	Tree planting	14,870 Ac.	14,870 Ac.	7,400 Ac.
	Roadsides	1,400 Ac.	1,400 Ac.	700 Ac.
	Gully plugs, silt basins, and sediment traps	2,700 No.	1,250 No.	625 No.
	Forest protection			
	Fire	305,600 Ac.	305,600 Ac.	305,600 Ac.
	Livestock	51,700 Ac.	40,000 Ac.	12,000 Ac.
	Forest improvement			
	Harvesting assistance	70,000 Ac.	40,000 Ac.	20,000 Ac.
	Timber stand improvement	170,000 Ac.	75,000 Ac.	25,500 Ac.
	Forestation	23,130 Ac.	15,000 Ac.	15,000 Ac.
	Urban land treatment	84,000 Ac.	54,000 Ac.	
	Soil surveys	100,000 Ac.	100,000 Ac.	50,000 Ac.
Flood prevention	Watershed projects	13 No.	7 No.	4 No.
	Floodwater-retarding structures	78 No.	61 No.	43 No.
	Channel improvement	280 Mi.	230 Mi.	160 Mi.
Water quality	Flood plain management	128,000 Ac.	64,000 Ac.	35,000 Ac.
	Sediment reduction	8,000,000 Tons	2,000,000 Tons	1,000,000 Tons
Recreation	Water-based recreation 3/			
	Land	6,900 Ac.	1,500 Ac.	970 Ac.
	Water	8,120 Ac.	2,875 Ac.	2,875 Ac.
	Recreation man-days	3,200,000 M/D	1,639,200 M/D	1,573,000 M/D
Fish and wildlife	Fish habitat 3/	25,280 Ac.	6,857 Ac.	2,855 Ac.
Environmental quality	Natural beauty		Enhanced	Enhanced
	Fish and wildlife		Enhanced and improved	Enhanced and increased
	Vegetation		Improved	Improved
	Air quality		Same	Same
	Water quality		25% improvement	16% improvement
	Housing patterns		Improved site conditions	Improved site conditions
	Sediment production		Reduced 25%	Reduced 15%
	Erosion		Reduced 30%	Reduced 15%
	Woods and open field burning		Reduced 25%	Same

1/ Includes 100,000 acres severe sheet erosion on cropland.
2/ Includes 50,000 acres severe sheet erosion on cropland.
3/ Estimated at 2/3 combined Chickasaw and Hatchie needs.

Table 9.3 - Impacts of Alternative I and II forestry programs
Chickasaw-Metropolitan Basin

Forestry program	Program summary: Total need to 2020	Alternative	Program summary: Planned for 15 years	Program summary: Cost of 15-year plan	Impacts and benefits: Runoff effects	Impacts and benefits: Sediment effects	Impacts and benefits: Water quality effects	Environmental effects	Basic forest resource value effect	Forest economic base	Employment opportunity effects
	Acres		Acres	Dollars							
Critical area planting	14,870	I	14,870	729,000	5% reduction	80% reduction	5% improvement	Replaces raw soil with tree cover	Long-term up to $1.85 per acre	Up 118%	Long-term will increase
		II	7,400	350,000	2%	40%	2%				
Watershed protection (566 only)	110,000	I	40,000	800,000	3% reduction	5% reduction	5% improvement	Improves forest appearance and habitat	Reduces base value: 3.27%	None	None
		II	22,000	340,000	1%	2%	2%		Unknown		
Forest fire prevention-protection	305,600	I	305,600	1,275,000	5% reduction	80% reduction	5% improvement	Maintains forest cover reduces air pollution	Protects an average value of: I $4.26/A	Maintains rate of change	Maintains base
		II	305,600	795,000	1%	20%	1%		II $0.91/A		
Special industry-state harvesting assistance	20,000 per year	I	20,000 per year	40,500	None	None	None	Reduces damage from destructive logging	Long-term up $3.00/A	Up 33%	Maintains base
		II	0	0	-	-	-		--		
Other forest land treatment	260,000 (70,000 per year)	I	170,000	1,720,000	3% reduction	5% reduction	5% improvement	Improves forest appearance and habitat			
		II	50,000	500,000	1%	2%	2%		No change		No change
Urban forestry program	County-wide	I	--	450,000	5% reduction	40% reduction	5% improvement	Improves community appearance, reduces harshness of climate, raises property values.	Effect on land value not forest	No effect	Unknown
		II	0	0	0	0	0				
TOTAL		I		4,564,500							
		II		1,985,000							

1965 value of forest-based activity $3,272,000.
2000 value of forest-based activity $14,800,000 (with PL-566 program under Alternative I - No data for Alternative II).
2020 value of forest-based activity $15,200,000.